F-15 STRIKE EAGLE® II

INSTRUCTION MANUAL

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F-15 STRIKE EAGLE® III

Hans Halberstradt/Arms Communication

MICROPROSE®
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F-15 STRIKE EAGLE III

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F-15 STRIKE EAGLE III

Designer/Manufacture: McDonnell-Douglas (MCAIR)
Role: Strike Fighter
Crew: Two
Mission Weight at Takeoff: 35 tons
Engines: Two Pratt & Whitney 229s

Range: 1,200 miles
Ceiling: 65,000 feet
Max Speed at 0: 810 knots
Max Speed at 36,000 feet: 1260 knots
Maneuverability: Very Good
Cockpit Visibility: Exceptional 360 degrees

FORWARD

F-15 III is the most realistic and comprehensive computer simulation game seen to date. If somehow a computer keyboard could be retrofitted with a JFS handle, the simulation would be complete. With phenomenal skill, the programmers and artists at Microprose have created visual sensations up to now only available in a real F-15 fighter. Having flown more than a few hours in the F-15, I can attest to the accuracy of the instrumentation, weapons simulation and scenario development. The sensation of speed and adrenaline pumping feelings created by the enemy horde descending upon you while you alone attack targets, are awesome.

After playing this game I watched a basketball game and when the horn sounded for a player change, I was out of my seat, in the scramble mode. A basketball horn is the same sound as an alert Klaxon and the rush from the F-15 III game awakened those same sensations developed over the years. This is true realism! Play this game and you are there.

Inside all of us, a fighter pilot exists, trying to get out. You will become so immersed in the realism created that you will probably begin to speak in short concise phrases that your mother would not approve of. But it is in that competitive spirit that is born a true test of your mettle. Can you hack it? Check six pal, — I'll be watching.

— George P. Wargo, Lt.Col.,
USAF (ret.) "Wildman"

George P. Wargo, Lt. Col., USAF (ret.)

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A NIGHT ON THE TOWN

"Marlin 63 should be just ahead on the left," Captain Mike "Cherokee" Livingston calmly calls over the intercom from back in the pit. "He should be just turning on the southern leg of the tanker track, so you'll need to come about to 345 after you pick up a visual."

With this heavy load, you had to take off light on fuel. Even under full burner, it was a long run out until you could feel the air caressing her wings. A quick eight thousand pounds, and you'll be ready for a little excursion to downtown Baghdad.

Just ahead, you can now pickout the KC-10 silhouetted against the bright dusk sky. You should be able to hook up with just some light to spare. Never cared much for nighttime refueling; it's just a little too spooky out there with just the tanker's Director Lights glowing above your head. Anyway, you always turn her over to Mike so he can grab a little air time. Wizzos are not rated pilots, but any pilot worth his salt bends the rules to get his back-seater some time on the stick.

Over your left shoulder, you see the fuel boom slide perfectly into the receptacle on the first try. You call over the UHF set to the tanker's boom operator, "Hey boomer, must have had your eyes closed."

You give them a little grief just so they don't get too cocky, but there isn't a tanker pilot that ever has to worry about buying his own at the Officer's Club - you know who takes care of you out here.

With the fueling complete, it's time to get down to work. You call up the TSD on the MPCD located in the lower center of the cockpit. Mike'll have the same display up on one of his two color displays. After checking out the flight path and the heading to the first steer point, it's down to the deck.

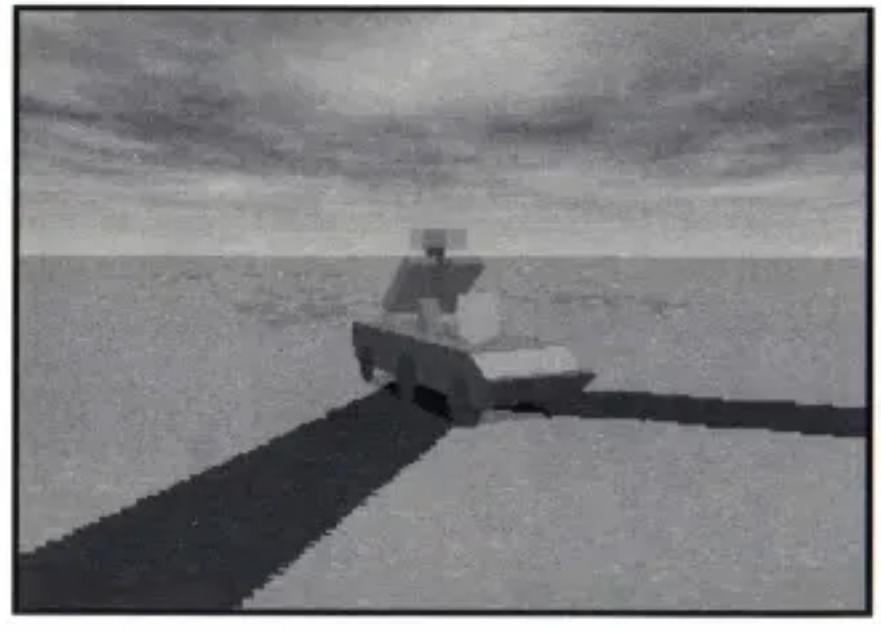
Two hundred feet is showing on the HUD's altimeter, so you activate the TF Radar and toggle the auto-pilot to the ON position. As the first obstacle approaches you start to feel yourself start to come out of the seat. You know the "Mudhen" has great avionics, but flying this close to the ground with your life in the hands of a few circuit boards is still unsettling. You start to reach for the stick, but the system takes you over the hill with nary a wink.

"Hey, relax will ya," Mike pipes in. "If you keep jumping like that, you'll be wore out before we ever reach the target. You know you get cranky when you're tense. Let the systems do their job. We're rid'in in the best aircraft in the world. This baby can do the job, if you'll just let her."

His timely ribbing seems to have taken the edge off. But not to be out done you shoot back, "What's a wizzo know about flying anyhow, the only ground you ever see is the dirt you're always kissing when we get back from a mission."

This friendly banter has almost become a ritual between you and Mike. Never planned or staged, still, it seems to happen at just the right time. That common link between a pilot and his WSO, one knows when to talk, shut up or just do the job.

SA-8 "GRECKO"

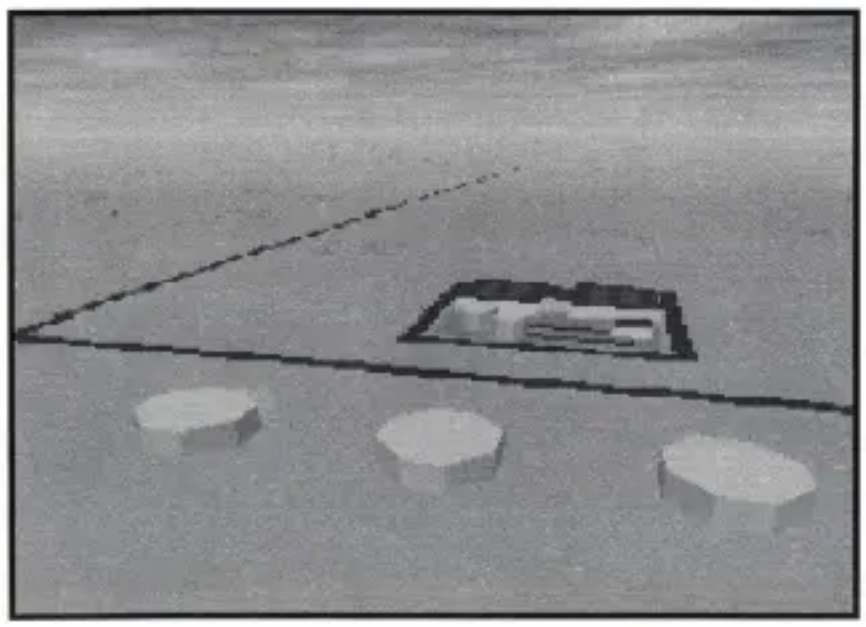


At planned intervals, you activate the F-15E's enormous APG-70 radar to scan the approach for hostiles. Not much chance anything will be out there after the beating the Iraqi air took down this corridor. But just in case, you slew the radar's antenna up about 10 degrees since there can't be any aircraft below other than the ones that'll never fly again.

The display reads clean and clear; just like the other six times you checked. AWACS has reported clear air all the way into the target. You wish the chance to fly some missions in the western approaches had materialized. Those guys have had the good fortune to mix it up with a few MiG-29s. Yours may not be the sexiest duty, but this war will be won by neutralizing ground installations; air combat is strictly a sideshow at this point.

Mike has had his face buried in his displays for some time. No need to check up, he really knows his stuff. Never a doubt that he'll get you right to the mark. He's a master with the RBM and HRM systems. Some of the guys back at the squadron have pegged him "Rand McNally" for his skill with the mapping systems.

CHEMICAL PLANT



Starting to get some chirps out of the TEWS; must be getting close to the few that are left; things should start to get hot. As if right on cue, Mike calls out, "Spike Mud! SA-8..120..20."

A quick Juke to the left should loose that turkey. The AN/ALQ-135(V) jammer has already started to send out its stream of noise. Those guys'll see so much clutter on their scope they'll look outside to see if its snowing.

You shoot off a quick burst transmission to "Blackjack" in the J-STARS aircraft. He'll vector a loitering A-10A flight to that location. That SA-8 won't have to wait for the holidays for a few gift wrapped Mavericks.

You press on to the target, a chemical weapons plant on the outskirts of Baghdad. The Iraqis'll call it a civilian target; something like a fertilizer plant. That's just PR hype. The output from this plant stops all growth; there's nothing beneficial being made at this facility. The GBU-10s you're carrying should make short work of it. Mike's been feverishly designating HRMs of the target area; he's already down to 1.3 nautical miles maps. Keeping maximum squint has assured a great picture of the target area.

"Approaching IP, punch it up to 300 knots," Mike calls, matter of factly, from the back.

Mike's got her painted up pretty with the LANTIRN's laser designator. You press the pickle button and feel the 2,000 pounders fall off the rails. The adrenaline rush blocks out all other inputs as temporal distortion takes over. Everything seems to slow down as if your watching the scene go by in slow-motion.

The target lights up in a flash that temporarily blinds the FLIR image. No need to see where your going, it's all planned out. A 4 G off right quickly turns into a 6 G gut buster as you pull her away from the target. The triple-A will erupt at any moment but they haven't made the one that has your name on it.

No time to hang around and admire your handiwork. It's time to begin your RTB. You ask AWACs for a pigeon to home plate, and receive an all-clear to Al's Garage. Just to relieve the tension you fire off one last shot, "Mike, you can look out now, I've done all the hard work."

A totally successful mission; this is how you've trained for years. It has really paid off.

Randy Jolly/Arms Communication

1. INTRODUCTION

In the movie "Firefox," Pentagon officials panic when it is learned that the Soviet Union has produced an ultra high-tech jet fighter. This prototype aircraft supposedly incorporates the latest Soviet technological advances. The Firefox is constructed from a titanium alloy and equipped with thought-controlled weapon systems. Able to sustain a speed of Mach 3 at low altitudes, it is at least a generation ahead of the competition. If mass produced, the aircraft would revolutionize warfare and allow the Red Air Force to sweep the skies over Europe.

The hero of this movie is a retired USAF captain, played by none other than Clint Eastwood. He is blackmailed into stealing the Firefox from a secret airbase right out from under the Soviet's noses. Once in the hands of Western experts the aircraft would be dissected and Soviet technology closely studied. Fortunately, it was only Hollywood fiction. The Soviet Union never built a Firefox and Clint Eastwood went on to become mayor of Carmel, California.

The movie does have some basis in fact. In the mid-1960s, the Soviet Union produced a high-speed interceptor which caused quite a stir among Western military circles. Designated "Foxbat" by NATO officials, the MiG-25 was credited with having unbelievable speed and possibly a new generation of air to air missiles. This aircraft was the real-life equivalent of Hollywood's nightmarish Firefox.

Rather than steal a Foxbat, however, the USAF reacted quickly and began its own new fighter program. A demanding set of specifications drove up the dollar cost of each plane into the tens of millions. But scary talk on Capitol Hill about the MiG-25's abilities certainly helped to loosen a few purse strings. As usual, the United States spared no expense when it came to competing with the Soviets, and the F-15 Eagle was born.

The F-15 program grew out of the desire to produce a fighter able to combat the Mig-25 and reassert the USAF's supremacy in the field of aircraft design. Since the United States could only afford a few of these planes, each would have to be the equal of many Soviet fighters. The goal was to produce a limited number of aircraft, but aircraft such as the world had never seen before.

MicroProse's F-15 Strike Eagle III showcases the "E" model F-15, the latest two-seat ground attack variant of this highly effective fighter. Affectionately known as the "Mud Hen" by its crews, the F-15E does its job at low altitudes (down in the mud). Though the F-15E is first and foremost a strike aircraft, it still retains all the strengths of a first class dogfighter.

In *F-15 Strike Eagle III*, you are given an opportunity to experience this multi-million dollar aircraft first hand. Essentially, you (as the pilot) are assigned missions in one of three different theaters. How you accomplish the various missions is entirely up to you. Do you fly low to avoid detection, keeping your head in the soda straw and trusting your LANTIRN? Or do you brave the SAM and triple-A threat and fly at a higher altitude?

Because the F-15E features so many complex systems, as a pilot your hands are full just flying the plane. To help out, the F-15E has a second seat installed for a Weapon Systems Officer. Assuming the role as the "Wizzo," you have additional tasks associated with managing the ordnance load. While the pilot is flying the plane, the responsibility for dropping bombs or firing missiles is yours.

In its ground attack role, the F-15E packs a powerful punch. Depending upon the mission, flight crews have a wide range of ordnance to choose from. For air-to-ground missions, a host of laser-guided "smart bombs" and standoff weapons can be mounted. If a heavy air threat is expected the F-15E is able to launch both heat-seeking and radar-guided missiles.

While the aircraft is designed to withstand the tremendous g-forces exerted in combat, the human body is not. Therefore, performance of the F-15 will be less dependent on what the aircraft can do and more on what the two men inside can take before blacking out. The aircraft will respond to your every command but how well you do in combat rests solely upon your own abilities.

F-15 Strike Eagle III is designed to be the ultimate in realism, whether dropping "smart bombs" on Baghdad or taking on enemy fighters in MiG Alley. The only thing missing is fear and maybe some good-natured "ribbing" from your squadron mates if you screwup a mission. Most of your time is taken up performing the various jobs involved in completing the mission. But there are times when you are able to sit back and enjoy the sights.

DEVELOPMENTAL HISTORY

During the Korean War, the United States Air Force learned an obvious and expensive lesson. In combat, it is never a good thing to have the second best aircraft. Soviet MiG-15 fighters extracted a terrible toll from our slow moving B-29 formations over MiG Alley. Our fighter escorts, prop-driven Mustangs left over from WW II, were likewise no match for the power of these new jets. Only the hurried introduction of the F-86 Sabrejet managed to salvage the deteriorating situation in 1951. Even with the F-86, maintaining air superiority was no easy task.

In the Soviet Union, Chairman Khrushchev was boasting that Soviet factories were turning out "missiles like sausages." The war industry that had been built up during the Great Patriotic War (WW II) was still producing military hardware at break neck speed. Coupled with the Soviet Union's domination of Eastern Europe and communist rhetoric, expansion at the expense of Western democracies seemed imminent.

At the same time, the United States along with its allies embarked on a policy aimed at containing communist expansion. Our very existence appeared to rest on our ability to stay one step ahead of the Soviet military behemoth. On the cutting edge of this competition was the aerospace industry. Advances in aircraft design and engine performance came in rapid succession, but never fast enough.

At a time when ballistic missile technology was in its infancy, a "space race" was inevitable. During the Cold War paranoia of the Fifties and Sixties, the United States could not concede control of the military "high ground" of space. As far as the United States was concerned, military control of space started at sea level on up. From aircraft to spacecraft, control of space meant our children would "never have to sleep by the light of a Soviet moon."

In 1960, President Kennedy inherited the great military industrial complex that Eisenhower had warned against. Early in his presidency he announced his intention of landing a man on the moon before the end of the decade. What he was saying to the world, and to the Soviet Union in particular, was that he was willing to spend every dime we had in order to be first in aerospace technology. He had thrown down the gauntlet for the Soviets to pick up should they dare. And of course, fearing for their own survival, they did.

The United States did indeed keep Kennedy's word. We had beaten the Soviets to the moon and were winning the race to develop strategic nuclear weapons. But all this had come about by neglecting our conventional forces to a certain extent. We simply did not have the money to be first in everything. Sacrifices had to be made somewhere, and because we based our strategy on being able to obliterate the Soviet Union with nuclear weapons, conventional forces were low in priority.

The Korean War had shown us the error in allowing our lead in aeronautical technology to lapse. Stung by this experience, the USAF decided that never again would it become complacent. As a result, the Air Force entered the Vietnam War with an inventory of modern aircraft with vastly improved ordnance. Still, our experience over North Vietnam was not without its share of surprises.

Air combat over Vietnam took place at the dawn of the missile age, when it was believed that mounting a gun on an interceptor was unnecessary. With an array of air-to-air missiles to rely on, pilots should be able to shoot down their opponents in droves, or so the theory went. A gun was considered just extra weight. But once in actual combat and out of the realm of theory, pilots would lament their helplessness in close quarter combat. Toward the end of Vietnam, a gun went back on all fighter models. Even though warfare was supposed to be a long-distance push button affair, reality proved the fallacy of a number of air combat assumptions.

The Vietnam War proved the wisdom of having a strong conventional force on hand. Since the United States believed it important to confront communism all over the globe there inevitably would arise situations where nuclear weapons would be inappropriate. We weren't about to use nuclear weapons on either Vietnam or the Soviet Union. The days of massive retaliation were over now that the communists were able to respond in kind.

Both sides were operating under a new policy known as Mutually Assured Destruction (MAD). In other words, the side that initiated a nuclear war was commiting national suicide. Neither side would prevail regardless of who got in the first strike. MAD caused the United States to undergo a complete re-evaluation of its defense policies. It was determined that the strategic defense of Western Europe and other vital areas must be flexible, with gradated levels of escalation.

Under the new doctrine of "flexible response," conventional forces attracted more attention and began to take a bigger bite out of the military's budget. When analysts became concerned over Soviet advances in fighter technology, everyone took note. Even so, the United States and the West were often caught napping. Our self-assured attitude frequently lulled us into a smug disregard for Communist achievements. Sure, we said, they could mass produce military equipment, but most of what they built was junk.

Like Sputnik in the 1950s, two new fighters from Mikoyan- Gurevich (MiG) shocked the West. The Mig-23 "Flogger" was just coming on-line, signifying the beginning of a new generation in Soviet aircraft. But what really kept NATO officials awake at night was the introduction of the MiG-25 "Foxbat." When this aircraft was trotted out for the first time publicly near Moscow in 1967, all the fear of once again being second-best came to haunt the USAF.

Numerous stories regarding the MiG-25 quickly began to circulate and MiG hysteria became the order of the day. How much of this was genuine apprehension and how much was a calculated ploy to drive up the defense budget is unknown. But clearly, the USAF was facing a tangible threat. Even without the hype, the MiG-25 causing the Air Force to fear for its manned bombers. By its very existence, the MiG-25 was folding up one leg of our strategic nuclear triad.

Prior to the MiG-25's Moscow debut the Air Force was embarked on a Fighter Experimental (FX) program. But it wasn't until the Foxbat's premiere that adequate funding was made available. By this time the FX program had officially been designated F-15 and had become the USAF's primary procurement concern. McDonnell-Douglas (MCAIR) won the initial contract to produce ten single-seat F-15As and ten two-seat trainers (F-15Bs) in 1969.

Meanwhile, the United States got its first actual taste of the MiG-25. Between 1971 and 1974, Soviet Foxbats were stationed at Cairo West International Airport in Egypt. During the so-called War of Attrition with Israel, MiG-25s were routinely flown over the Sinai and along the Israeli coastline as far north as Haifa. It was an impressive display. The Foxbats could fly with impunity because nothing in Israel, or the West for that matter, could touch them.

Flying at speeds in excess of Mach 2.5 and at altitudes over 80,000 feet the Foxbats could perform reconnaissance missions over Israel whenever they chose. Radar operators in Tel Aviv could detect the MiGs but there was very little they could do. One operator even detected a MiG-25 travelling at Mach 3.2 over the Sinai. Israel had no way of knowing that these aircraft were only unarmed reconnaissance models. For all they knew these aircraft could suddenly descend upon their airfields and let loose a volley of rockets and bombs.

The Soviet display in the Middle East meant two things to Western analysts. First, the U.S. had nothing to match the flight envelope of this new fighter, and secondly, the SR-71 overflights of the Soviet Union were now vulnerable to interception. With an interceptor capable of flying at over Mach 3, the Soviets had certainly proved their technological prowess. It was now up to the United States to develop a worthy rival.

By the time the first F-15 was ready to be unveiled over 2.5 million man hours had already gone into the project. On 26 June 1972, F-15 # 71-0280 was rolled out of the MCAIR facility in St. Louis. After an appropriate ceremony, the aircraft was disassembled and taken aboard a C-5 Galaxy to Edwards Air Force Base in California.

The F-15's maiden flight was flown on 27 July 1972 by Irving Burrows, MCAIR's project pilot. Lifting off from runway 22, Burrows flew for almost an hour while accompanied by two RF-4C chase planes. Despite

some early problems with vibration, subsequent tests began to run smoothly. Each of the ten initial aircraft was earmarked to test specific parts of the aircraft, i.e. engines, weapon systems, flight controls, etc. The first two-seat model, #71-0290, was flown on 7 July 1973. These F-15B models were initially used as instructor/trainers and not designed for a ground attack role.

In 1974, the first operational F-15s went to the 58th Tactical Training Wing (TTW) stationed at Luke Air Force Base in Arizona. These squadrons were used to qualify the future pilots. Less than two years later on 9 January 1976, the 1st Tactical Fighter Wing at Langley AFB received its first fully operational aircraft. By the end of 1976, two additional squadrons were outfitted with Eagles. The 27th, 71st, and 94th Tactical Fighter Squadrons of the 1st TFW were declared operational early in 1977.

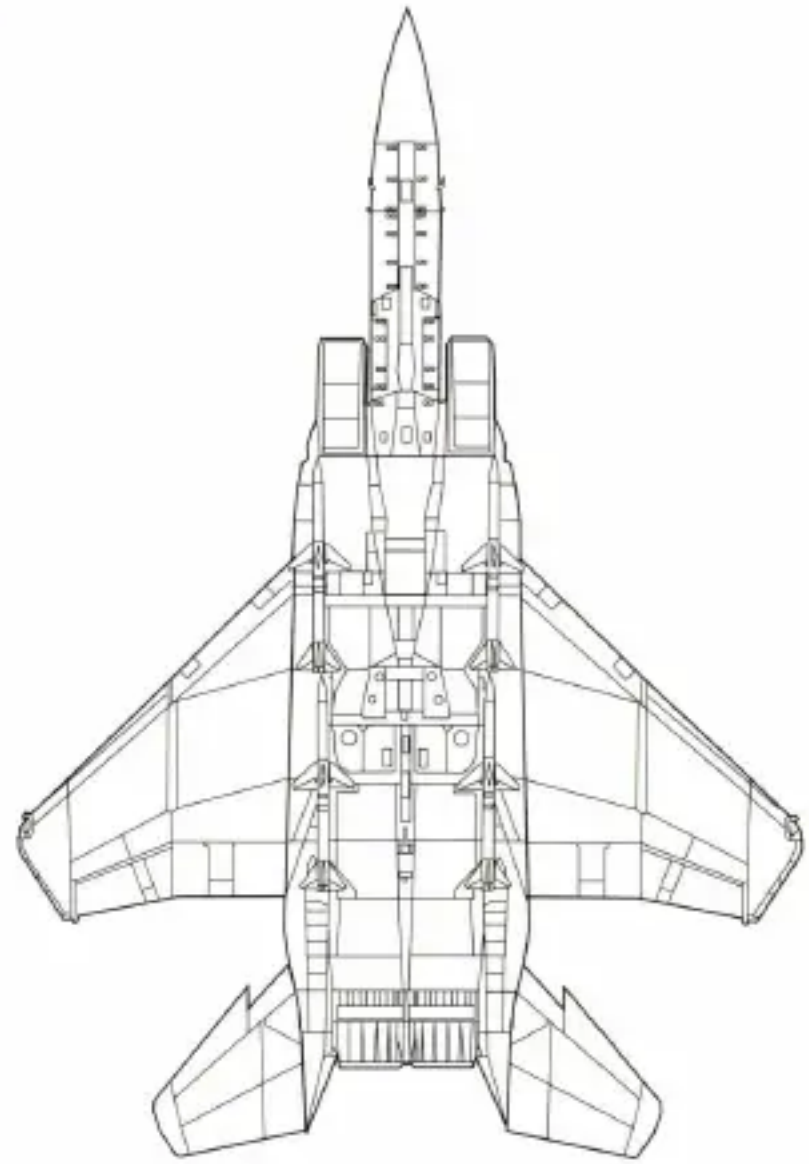
Just as the first F-15s were being introduced into active service, the myths surrounding the MiG-25 were being dispelled. In 1976, Soviet pilot Lt. Viktor Belenko flew a Foxbat to Japan's Hakodate Airport and promptly defected. Although his aircraft was eventually returned, Western experts were given a once in a lifetime opportunity to get up close and personal with the Foxbat. The pride of the Soviet Air Force was literally dissected almost overnight and found not to be the stellar leap in aviation that everyone had believed.

In mid-1979 the A & B model F-15s were replaced by the current C & D production models. The C & two-seat D variant reflect the natural course of development, incorporating changes made as a result of extensive flight testing and experimentation.

Externally, there is little noticeable structural difference. However, these later models have been modified to accept conformal Fuel And Sensor Tactical (FAST) packs. These packs are aerodynamically designed fuel pallets which significantly increase the aircraft's combat radius. They also allow for a wide array of electronic sensors, laser designators and optical equipment to be carried.

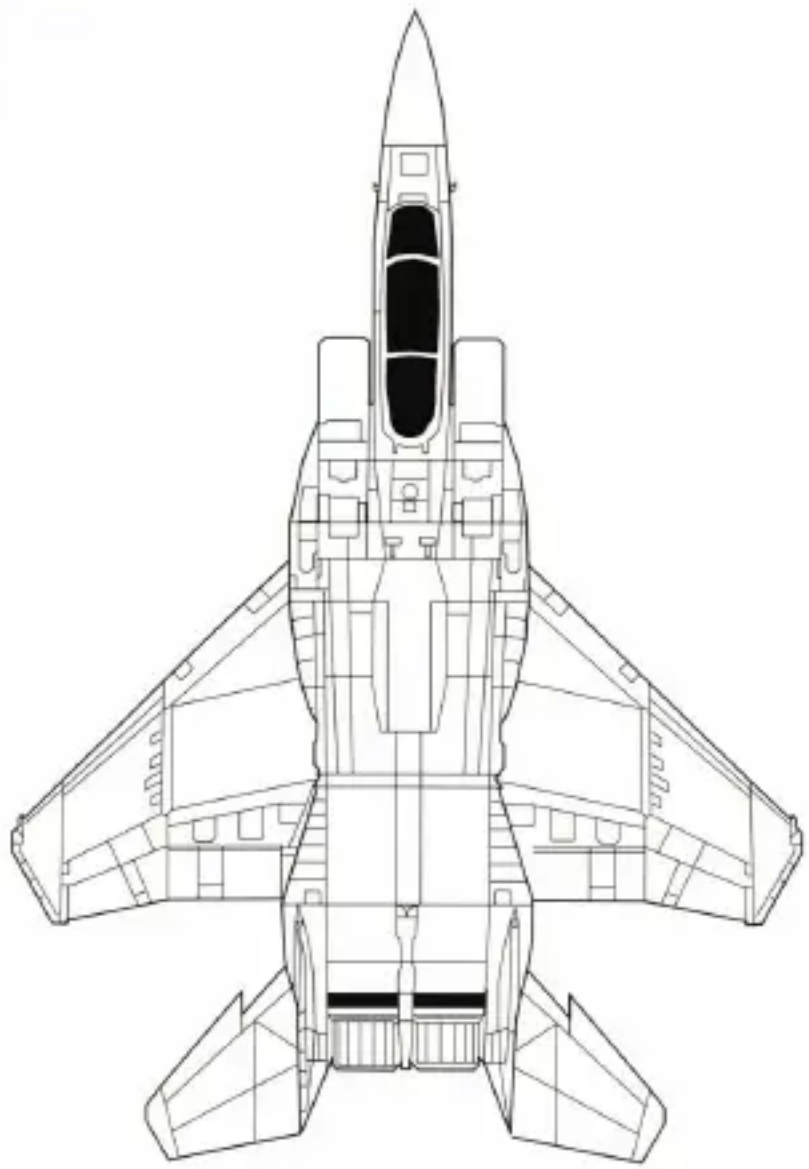
Internally, major improvements and equipment upgrades were made to the aircraft's avionics suite. The early APG-63 pulse-doppler radar for example, was enhanced by the addition of a programmable signal processor (PSP). The PSP allowed radar modes to be controlled by software rather than being "hardwired" into the circuitry. Further modifications gave the APG-63, synthetic aperature radar (SAR) capability which could provide sharply detailed resolution down to 10 feet. From a distance of 30 miles, the -63 radar could pick out street patterns and other minute terrain features.

F-15E, BOTTOM VIEW



The early A & B model F-15s proved their combat capabilities in the Middle East on a number of occasions. Because of the political significance

F-15E, TOP VIEW



attached to the MiG-25 overflights, Israel was the first nation cleared to accept F-15 exports. It would also be the first nation to use them in actual combat. In December 1976, 25 Eagles were delivered to the Israeli Air Force (IAF). Less than three years later, these aircraft engaged a superior number of Syrian MiGs and defeated them without loss.

With the advent of the much improved C & D models, the F-15s reputation as a top notch fighter was assured. But despite the advanced avionics and proven ability to carry ordnance, ground attack was still only considered a secondary function. In a program sponsored by MCAIR and dubbed "Strike Eagle," a two seat B model was converted in 1979 into a rudimentary ground attack fighter. Thirty percent of the F-15's airframe was altered to accommodate the equipment needed for this new role.

Flown for the first time at the 1980 Farnborough Air Show, the aircraft was equipped with additional external hardpoints and back seat weapons display terminals. The key to the conversion though had been the increased power of the F-15s flight computers and an improved SAR capable AN/APG-63 radar system. The aircraft now enjoyed almost real-time ground mapping capability. This allowed potential targets to be surveyed by the attacking aircraft well in advance of their arrival.

Equally important was the F-15s ability to carry this additional payload without a significant tradeoff in terms of performance. In other words, the F-15 could act as a fighter-interceptor even when configured for ground attack. It was envisioned that the converted aircraft would assume the dual role of an all-weather strike fighter, a role currently played by the aging F-111s.

Having passed through numerous budgetary and design hurdles, the Strike Eagle program officially kicked off with a series of viability studies in late 1982. Competing against the F-16XL, Congress decided that there was a need to maintain both programs at "sustaining levels" of procurement. The full program go-ahead was announced on 24 February 1984. The FY 1984 budget contained funds to acquire 48 F-15E Strike Eagles. These aircraft would be brought up to D model standards and then further enhanced with sophisticated navigational and targeting pods.

The first officially titled F-15 Strike Eagle was #86-0183. It was truly a revolutionary aircraft dedicated to precision ground strike missions. The addition of a back-seat Weapon Systems Officer gave the aircraft an unmatched capability to deliver ordnance. In its alternate role, that of a fighter, the F-15 has proven to be an excellent air-to-air platform. With a complement of high-tech missiles and long-range radar, the basic fighter design of the Eagle is unparalleled.

F-15E, SIDE VIEW

Originally scheduled to replace the Vietnam era F-4 Phantom, the F-15 was designed and pushed into service to combat the MiG-25 scourge. After spending years in development, the Eagle finally did meet the MiG-25 in a climactic battle. It wasn't the type of battle that wins wars or saves nations but rather the culmination of millions of man-hours of effort. The USAF had pinned its hopes on the F-15, it wasn't disappointed.

On 13 March 1981, a Syrian MiG-25 attacked a lone Israeli aircraft performing a reconnaissance mission over the Golan Heights bordering Israel and Syria. As fate would have it, the reconnaissance plane was an RF-4, the very aircraft the Eagle was to replace. As the Foxbat bored in on the Phantom an F-15 was directed to the scene. After a short BFM engagement, the F-15 shot down the MiG-25 using a radar-guided Sparrow.

Since then, the AN/APG-70 radar has been gradually replacing the AN/APG-63 on E-model F-15s. This new SAR capable radar system has a longer operational range, with greater sensitivity than its predecessor. It operates over a wider band-width and is able to track targets despite electronic counter-measures (ECM).

Basically, the radar scans a 120 degree arc in front of the aircraft's nose. The Weapon Systems Officer then receives a high resolution return image. The quality of these radar images approaches what one might expect from a standard photo. The images are then processed and stored in the aircraft's on-board computer systems so that the radar does not have to operate continuously. This cuts down on the enemy's opportunity to detect the F-15's radar emissions.

In addition to the APG-70 radar, F-15Es are usually fitted with LANTIRN pods (Low Altitude Navigation and Targeting Infrared for Night) when performing ground strike missions. The LANTIRN system is actually a pair of pods which are mounted on external hardpoints beneath each engine inlet. One of these pods is used for targeting while the other is reserved for navigation.

The AN/AAQ-13 Navigation pod contains a wide-angle Forward-Looking InfraRed system (FLIR). FLIR images are displayed on the pilot's Head-Up Display (HUD) directly in front. Combined with the terrain-following radar also contained in the navigation pod, allows the aircraft to operate at low altitude even at night.

The Targeting pod contains another FLIR with both wide and narrow angle field of vision. This FLIR is used to track targets and is equipped with a laser-designator. Individual targets within the FLIR images may then be marked. Using information passed on by the targeting FLIR, "fire and forget" weapons may be launched or "smart" bombs guided to their target by lasers.

Besides possessing excellent maneuverability and effective air-to-air missiles, for self defense the F-15 can also rely on a sophisticated avionics suite. The Tactical Electronic Warfare System (TEWS) is an integral part of the F-15s ability to protect itself from a variety of threats. As a part of the total design package, the TEWS does not constitute additional weight nor detract from the ordnance normally carried.

The two main components of the F-15s TEWS are the AN/ALR-56 and AN/ALQ-135. Mounted internally these electronic aides are autonomous systems which operate continuously. Even if the crew is pre-occupied with other tasks, the TEWS guards against surprises.

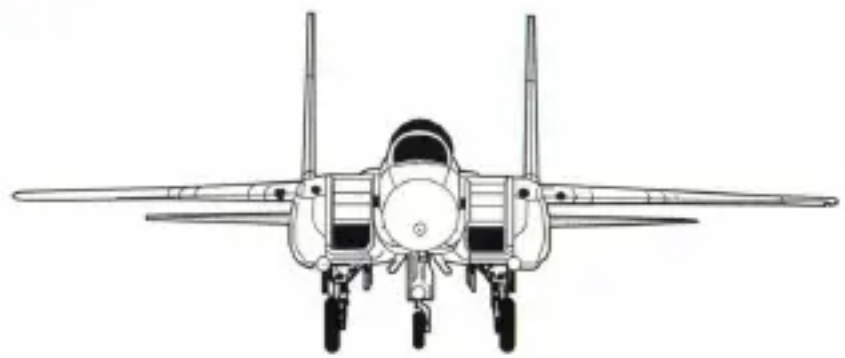
The AN/ALR-56 is an internally mounted Radar Warning Receiver (RWR) system. The package includes five wing-tip and fuselage antennas which provide 360 degree coverage. It can be selectively programmed to scan a wide band of the electro-magnetic spectrum. Equipped to eliminate false returns or intentional deceptions, the system provides visual and audio cues to the pilot when a threat is detected.

The AN/ALQ-135 is an advanced electronic jamming system featuring powerful wide-band transmitters. It is mounted internally and works in conjunction with the RWR to hamper the ability of enemy radar to achieve a "lock" on the aircraft. It is also able to confuse radar-homing missiles during their terminal phase of flight.

The F-15 can also be configured with mission-specific ECM pods or dispensers to confuse enemy radar systems and protect against SAMs. For example, the AN/ALE-45 is a computer controlled dispenser system which operates automatically in response to threats detected by the RWR. It may also be operated manually by the pilot. The system features compartmentalized plug-in memory which can be quickly be reprogrammed.

The Eagle's dominance as a fighter began early in the 1980s. But it wasn't until the Gulf War in 1991 that F-15s would be given an opportunity to display their air-to-ground prowess in combat. Indisputable proof of their effectiveness in this role would be later broadcast on network television. Courtesy of the high-resolution FLIR on board, we were all able to get a grasp of what the pilots were going through from the comfort of our homes.

F-15E, HEAD ON VIEW



F-15 Strike Eagle III by MicroProse, takes this one step further. Now, you can actually perform all those missions you were able to see during the Gulf War, and much more. In addition to the historical Gulf War theater, two future theater scenarios, Korea and Central America, are included to round out this action packed flight simulator. Enjoy.

Hans Halberstradt/Arms Communication

2. OPERATING INSTRUCTIONS

I. INTRODUCTION

The United States Air Force has a six month training course designed to teach its qualified pilots to fly the F-15E. Part of this course is devoted to the use of computerized flight simulators, much like MicroProse's *F-15 Strike Eagle III*. The Air Force paid $50 million apiece for theirs. Now, you are able to fly the F-15E for considerably less and without the six month ground school.

While *F-15 Strike Eagle III* makes use of some features common to previous flight simulations, it represents a new generation in design authenticity. It is quite unlike any computer flight game you've ever flown before. Our design team has literally spent thousands of hours trying to recreate the realism and excitement of taking part in actual F-15E missions. The result is a highly accurate yet sometimes complex flight simulator.

Because many of the new design concepts are not intuitive, the simulation takes a little additional time learning how and why things work the way they do. We believe this will be time well spent.

You are given a greater degree of individual latitude than actual Air Force pilots. You are responsible for selecting your own ordnance, choosing a flight profile, and performing a wide variety of missions. In fact, your career depends on how well you are able to use the many weapon and detection systems. All the tools are there but it's up to you to learn how best to use them.

To alleviate problems you may encounter in understanding these new concepts. The manual has been divided into two separate categories of Reality options: ***Standard Mode*** and ***Authentic Mode.*** It is recommended that you begin by setting the Reality options to *Standard Mode* initially.

Even though *Standard Mode* makes operating these flight systems somewhat simpler, it should not be thought of as a beginner's level. It is, however, an excellent way to gradually incorporate the more difficult *Authentic Mode* portions of the simulation.

Once you are comfortable with how a particular feature operates in *Standard Mode*, you can change it to *Authentic Mode* to increase your overall difficulty level (and score). This mode tests your abilities as a Pilot and/or Weapon Systems Officer (WSO) just as if you were flying an actual F-15E.

We don't have six months to train you, so you may have to refer to the following Operating Instructions frequently at first. Because of its realistic approach *F-15 Strike Eagle III* has been designed to allow you to make the transition to *Authentic Mode* gradually.

Carefully study the screen illustrations accompanying the text. These illustrations will help you to identify the symbology being used, particularly that which is displayed on your **Head-Up Display**. The **HUD** quickly becomes cluttered with information once in combat so you must know ahead of time which displays are most important. To assist you, a glossary and index have also been included as appendices to this manual.

It is a good idea to keep the **Key Reference Card** nearby until you are familiar with all the flight commands. Flight commands have been grouped on the Key Reference Card according to their functions: Flight controls, Weapon System controls, Simulation views, etc. Certain keys are obviously used more than others during play, but after a few missions, the whole range of key commands will become second nature. In the meantime, use the ***Pause* (alt p Key)** to halt the simulation whenever you need to look up a particular command.

Finally, don't get discouraged if it doesn't come to you the first time around. The design team has concentrated on historical accuracy and an attention to detail far above anything found in other simulations. Just stick with it and remember, the only thing we didn't throw in is course credit for learning to fly the F-15. The Air Force will have to give you that itself.

PAUSE OPTION

Remember that you may halt the simulation at any time simply by pressing Pause (alt p Key). Because the Pause feature is a luxury not available to pilots in the real world, "purists" are sometimes reluctant to use it. You don't need to feel this way, at least during your orientation. The pace of modern air combat does not allow time for you to flip through this manual while flying, so use the Pause feature any time you need to refer back to a section of instructions.

The following chapter provides instructions on how to operate your aircraft and weapon systems using the keyboard, *Controller*, and *Selector* functions. It includes separate stand-alone sections on both *Standard* and *Authentic* Modes.

For those who can't wait to get into the air, the Quick Start option gets you up and flying with minimal instruction. It contains just the basic information needed to keep your F-15E flying, drop some bombs and perhaps shoot down a bandit or two.

For a more detailed briefing, read the respective Check Ride sections for both *Standard* and *Authentic Mode*. These sections are designed to familiarize you with the basic concepts and flight commands behind each of the flight modes. They can be viewed as "how to" primers on using the various weapons systems without all the technical jargon included elsewhere.

The *Standard Mode* Check Ride expands on the Quick Start introduction. The Check Ride takes you through an entire mission from start to finish. It explains how to engage enemy aircraft and how to drop ordnance on ground targets. It also prepares you for the inevitable jump to *Authentic Mode* flight.

The *Authentic Mode* Check Ride describes the workings of the various systems in their highest level of difficulty. It is referred to as authentic because you are operating the aircraft and controlling the weapons just as F-15E pilots do in real life.

Just remember that all Air Force pilots go through orientation periods when learning to fly a new aircraft, especially when that aircraft cost the taxpayers millions of dollars. Think of these Check Rides as your orientation. Beginning with the *Standard Mode* Check Ride, you can gradually increase the level of difficulty until you are able to fly the aircraft with all its systems set to *Authentic Mode*.

TERMINOLOGY:

Keys: When a key is referred to in this manual, its name appears in *italics* followed by the actual key press itself in parentheses.
Controller: This may be either a mouse, joystick, or set of directional arrow keys depending on your hardware.
Selector: refers to the mouse, joystick button, or key controls. Selector #1 refers to either the left mouse button or *Enter Key*, Selector #2 refers to either the right mouse button or *Spacebar Key*.

II. QUICK START

This section is for those eager pilots who can't wait to see downtown Panama City, shoot down a MiG over the Korean DMZ, or drop a bomb on Saddam's palace in Baghdad. Quick Start is provided purely as a convenience to those players who just want to install the simulation and jump right into the cockpit.

HOW TO START

Before you can begin the simulation you must install the program to your computer's hard drive. Follow the "**Installation and Loading**" instructions contained in the Technical Supplement. Make a note of the Installation and memory considerations which may be unique to your hardware.

Once the simulation is installed on your hard drive, you are ready to do battle. The first screen you see following the opening animation and credits is a hangar area. This screen is referred to as the **HOME Screen** and is normally used to configure your mission and access various simulation options.

Use your *Controller* to move the cursor over the F-15 parked in the background. When the cursor reads QUICK START, press *Selector #1*. You are immediately placed high above the desert floor over the Persian Gulf theater. If you wish to replay your last Quick Start mission, press *Selector #2*.

CHOOSING QUICK START THEATERS

While not recommended for Quick Start missions, it is possible to select one of the other theaters. Use your *Controller* to move the cursor over to the unfolded map in the foreground. When the cursor reads THEATERS, press *Selector #1*. From here you are able to select one of three theaters: Persian Gulf, Korea, or Central America. Choose one by pressing *Selector #1* over the desired theater box. You are then asked whether you wish to fly a single mission or participate in a campaign. For purposes of Quick Start, choose a single mission. You are automatically returned to the Home Screen after making your selection. Move the cursor over the F-15, press *Selector #1* when the cursor reads QUICK START.

DIFFICULTY LEVELS

Quick Start defaults to a Difficulty Level of 1, the easiest of the four levels. All of your controls, displays and features are pre-set to *Standard Mode* or are turned ON as the case may be.

BEGINNING QUICK START FLIGHTS

Quick Start begins with your aircraft already airborne in level flight with your engines operating at 100% power. Quick Start flight is considered a normal mission with the exception that you do not receive a point score. You are given Primary and Secondary targets, but you are essentially flying in a free-fire zone. You can drop bombs on anything you wish without worrying about civilian or friendly casualties. You may also regard any aircraft you detect as hostile. Shoot them down at will and sort them out later, at your leisure.

AIR-TO-AIR ORDNANCE

Quick Start has a default ordnance load which gives you four AIM-120A AMRAAM radar-guided missiles and four AIM-9M heat-seeking missiles. Launch your air-to-air missiles at any aircraft unfortunate enough to be detected by your radar.

Toggle the ***Master Mode* (m Key)** until the indicator on the instrument panel reads **AA** (Air-to-Air).

In Quick Start, the radar is already activated for you. The radar display appears as a 4 x 4 grid on the front cockpit MPD #1. When the aircraft is placed in Air-to-Air Master Mode, the radar detects all airborne targets in a 120 degree search arc. The search arc extends from the nose of your aircraft out to a maximum range of 80 nautical miles.

Your aircraft is centered along the bottom of the display, not in the center of the screen as you might think. Therefore, all aircraft appearing on the display are located in front of you. Enemy (and friendly) aircraft show up as small solid squares against the grid background. The position of the squares on the grid indicates their approximate range.

The radar range can be changed by toggling the ***Radar Range* (Home Key)**. The range can be set to 10, 20, 40 or 80 nautical miles. The individual horizontal breaks still represent 1/4 of the maximum range setting. For example, with a 20 nm setting, the individual horizontal breaks indicate ranges from 0 (your aircraft's position at the bottom), to 5, 10, 15, and 20 nm from your F-15E.

DETECTING ENEMY AIRCRAFT (TEWS)

In addition to radar, there is another method of detecting enemy aircraft. The **Tactical Electronic Warfare System (TEWS)** display consists of four concentric circles centered on an *x* and *y* axis. The current maximum range of the display is placed in the upper right corner. The *Standard Mode* TEWS has a maximum range of 80 nautical miles. It may be scaled in and out by pressing ***Zoom View In* (z Key)** and ***Zoom View Out* (x Key)**.

Before you are able to change the display's range scale, however, it must first be placed "in command." Press ***In Command* (alt Key plus the desired display number 1-7).** Four tick marks appear along the bottom edge of the display to signify that it is now "in command."

Your aircraft (the grey aircraft icon) is centered in the middle of the display. The TEWS display is oriented so that the upper portion is always in your aircraft's 12 o'clock position, i.e in front of you. Enemy aircraft and ground installations also appear on the TEWS display. Each is given a readily identifiable icon (aircraft, airbase, SAM installation, GCI radar, etc.)

MISSILE COMBAT

Quick Start equips your F-15 with both radar-guided and heat-seeking missiles. In order to fire these missiles, you must first have the desired target "locked" on radar. Because Quick Start places the radar in *Standard Mode*, all targets are considered already "locked" when they appear.

Only one target is ever "locked" at a time, however. If multiple targets appear, you may use the ***Designate Target* (backspace Key)** or ***Lock Target* (l Key)** to cycle through them. A Target Designator Box (TD) appears around the "locked" aircraft on your HUD. The target also appears "boxed" on the TEWS display.

Try to maneuver your aircraft so that the TD box is moved within the large circle in the center of the HUD. This circle represents the engagement parameter of the particular type of missile you have placed in priority. Once the TD box is maneuvered within this circle, you have a clear shot. Before you shoot, though, you should check to make sure that the target is within range.

A flashing symbol appears beneath the TD box once the target is within range of your missile. This symbol is known as a "**shoot cue.**" It is either star-shaped indicating an AIM-120A or triangle-shaped indicating either an AIM-7M or AIM-9M. Once you receive a shoot cue, press ***Pickle Button* (spacebar Key or Joystick button #2)** to launch the missile.

The **Lock-Shoot lights** are another form of shoot cue. These lights are located on the canopy braces in the upper corners of the cockpit screen. They illuminate when a target is "locked" and flash when you receive a shoot cue.

Not only are you able to watch a missile tracking the target from the ***Normal Cockpit View* (F1 Key)**, you are also able to hitch a ride on the missile itself. After firing a missile, press ***Missile View* (F7 Key)**. Your view perspective is from directly aft of the missile (or bomb) as it homes in on the target. (Just like Slim Pickens in the movie *Dr. Strangelove*).

"GUNS, GUNS, GUNS"

If the enemy pilot manages to escape your missile shot and closes in on you, switch from missiles to guns by pressing ***Guns* (1 Key)**. A gun-sight and pipper appears in place of the large circle on your HUD. Line up the pipper with the target and press ***Fire Guns* (enter Key or Joystick button #1)**. Each press of the key fires a short burst of 20 mm rounds out to an effective range of 3,000 feet, approximately 1/2 nautical mile.

RETURNING TO BASE

Since the Training Mode option gives you unlimited fuel and ordnance, you can conceivably stay aloft indefinitely. (Each time you press the ***Resupply* (alt r Key)** your fuel tanks and weapon stations are filled). Sooner or later though, you're going to want to come down. The Automatic Pilot feature makes it easy to return to base just in time to eat at the Officers' Mess.

AUTOMATIC PILOT

You may use the ***Automatic Pilot*** **(p Key)** at any time to place yourself on course to an active Sequence Point, either a target or friendly home airbase or Tanker Track. If you alter course or speed, the Automatic Pilot feature is disengaged. It functions the same as cruise-control in an automobile except that it also keeps you on a steady heading.

When you wish to return home, toggle the ***Next Sequence Point +*** **(s Key)** until you see "Home Airbase or Tanker Track" appear on the HUD. Press ***Automatic Pilot*** **(p Key)** to engage the Automatic Pilot. Once engaged, the automatic pilot heads you directly home.

ACCELERATED TIME

If you happen to be a long way from home, you can always speed up the action by pressing ***Accelerate Time*** **(shft t Key)**. There are eight incremental settings. Each of these settings progressively increases the speed of the simulation. The current setting is displayed on the upper left corner of the HUD (7x would mean time has been accelerated seven times the normal passage). You are always able to return to normal passage of time by pressing ***Normal Time*** **(t Key)**.

TRAINING MODE

Training mode **(alt t Key)** is one of the Reality options which is automatically turned On at the lowest Difficulty Level setting. While in Training mode you may ignore enemy fighters and SAMs if you wish; they cannot harm your aircraft. You may, however, shoot them down at will. Not very sporting, but after all this is only training. And because this is only training, you receive no score upon completing the mission.

Training mode is indicated on the upper left of the HUD by the letters **TRNG**. While in Training mode, you are protected from inadvertent contact with the ground. Rather than crash and end the simulation, your aircraft is placed in level flight at low altitude. You're then allowed to continue the mission.

You are also given an unlimited supply of missiles, bombs, and fuel. The aircraft can be completely replenished even in flight by simply pressing ***Resupply*** **(alt r Key)**.

You may leave or enter Training mode at any time by toggling ***Training Mode*** **(alt t Key)**. The letters **TRNG** will appear and disappear off the HUD indicating your current Training mode status. You receive no points for a mission if you've been in Training mode, no matter how briefly.

"SLEWING" THE AIRCRAFT

Another feature that can only be used when in Training mode is the ability to "slew" your aircraft. Using ***Slew*** controls **(alt** and the directional letter keys representing North, West, East, South; **alt s, alt z, alt c, alt x respectively)**, the aircraft can be moved to any point on the map simply by pressing a few keys. The aircraft arrives at the desired point without using up its fuel.

For example, you want to fly around Baghdad looking for trouble but don't want to spend time getting there from your airbase. In order to speed things up, you may use *Slew* commands to "fly" your aircraft directly there. It is recommended that you view the moving map (Tactical Situation Display) while using *Slew* commands to watch the progress of your aircraft.

ENDING A QUICK START FLIGHT

After having so much fun, why would you ever want to come down? At this level of difficulty, you are not required to actually land the aircraft. To end the mission successfully, all you need do is return to your airbase. When you arrive over the airbase, your aircraft is "grabbed" and landed automatically for you (Difficulty Level 1).

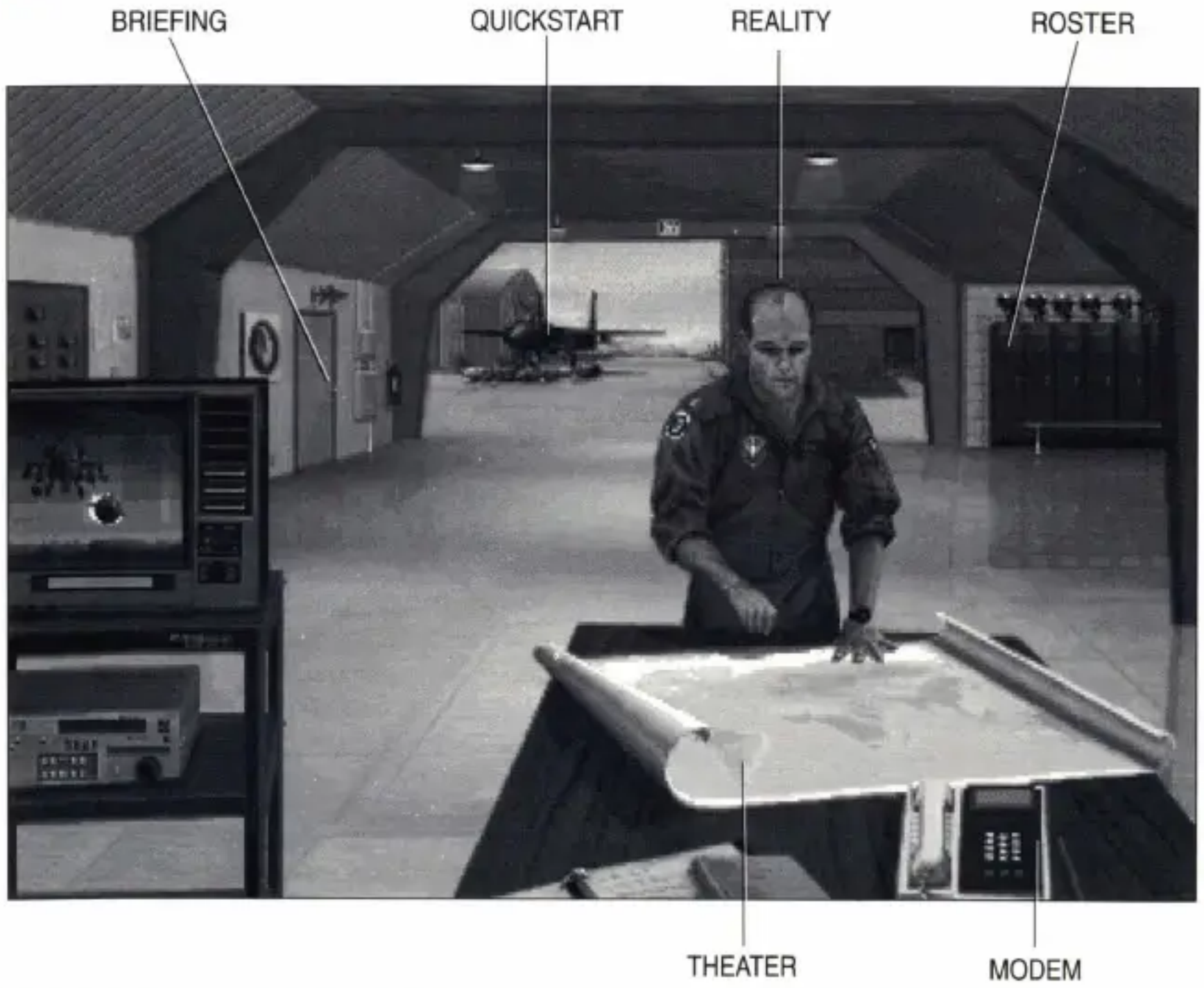
You may also abort the mission while in flight and immediately return to the Home Screen. To abort the mission you must first access the Menu bar by pressing the ***Escape*** **(esc Key)**. Press the ***Game*** **(g Key)** to bring up a second Menu panel revealing the abort mission option. Press the ***Abort Mission*** **(a Key)**.

You are also able to end a Quick Start flight at any time by pressing ***Quit to DOS*** **(alt q Key)**. You are exited completely out of the game when stopping play in this manner.

Upon completing a Quick Start mission, you are automatically returned to the Home screen. You have the option of either flying another Quick Start mission or setting up for a "normal" single or campaign flight.

III. THE HOME SCREEN

HOME SCREEN



When beginning *F-15 Strike Eagle III*, the first screen you see following the introduction and credits is a depiction of an airbase hangar area. This screen is referred to as the **HOME Screen**. Most pre-game activity takes place on this or one of the subsidiary set-up screens.

Adjoining the hangar area are a Briefing room, locker area and flight line. In the foreground of the HOME Screen is your Commanding Officer with a set of campaign maps unfolded on a table. This screen contains a number of cursor activated "hot spots." As you move the cursor over these areas you are able to access other screens.

BEGINNING A CAREER

To begin a career (or single mission), you are given an opportunity to tailor your missions by selecting various options. In addition, you are able to create or delete pilots (**ROSTER**) and choose between theaters of play (**THEATERS**). A number of (**REALITY**) options are accessed from the **HOME** screen along with a choice of difficulty levels. Once satisfied with your selections, you are then ready to receive your mission briefing (**BRIEFING**) and arm your aircraft accordingly (**ARMING**).

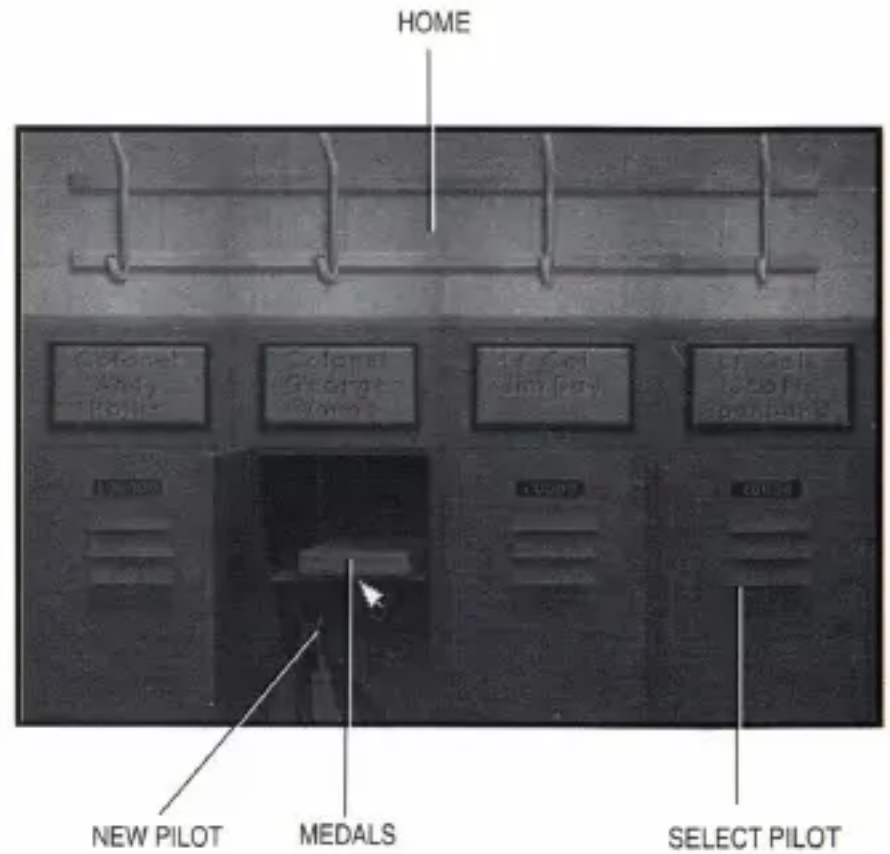
If you wish to bypass the regular mission generation options, you may begin the simulation already in flight (**QUICK START**). For air combat against a live opponent, take the time to set up for Modem play (**MODEM**) with a friend.

QUICK START

Quick Start allows you to begin play immediately. You may bypass the normal mission selection process by moving your *Controller* over the F-15E parked in the background. When the cursor reads **QUICK START**, press *Selector #1*. You are immediately airborne with a default mission and ordnance load. Note that initially Quick Start sessions start you off in Training Mode with all simulation controls pre-set to *Standard Mode*.

Quick Start missions do not require an active pilot. These missions are single flights which do not award any points to the player. Unless you change theaters prior to flight, all Quick Start missions are flown in the Persian Gulf (Desert Storm) theater.

ROSTER SCREEN



ROSTER

The Pilot Roster is accessed from the HOME Screen by moving your *Controller* so that the cursor is placed on the row of lockers in the background. When the cursor reads "**ROSTER**" press *Selector #1*. You are immediately moved to the Pilot Roster screen.

If you are using a keyboard only, the four arrow keys duplicate the functions of the mouse or Joystick. The *Enter Key* corresponds to Selector #1 and the *backspace Key* is used as Selector #2.

The Pilot Roster screen depicts a locker room consisting of eight personalized lockers. Note that in order to view all eight lockers you must use your *Controller* to scroll the screen. Each pilot placed in the Roster is given a locker and retains that locker until deleted from the Pilot Roster. This means that even if a pilot is KIA or Retired, the pilot's name remains.

The ID number on a locker is the pilot's accumulated point score total. This way, you can compare pilot standings by noting the number displayed on each of their lockers. Inside each locker are a number of the pilot's personal items to include; a box containing the pilot's ribbons and awards, flight suit, G-Suit, and personal effects bag.

CREATE A NEW PILOT

In order to fly any mission other than Quick Start, you must have an active pilot currently on the Pilot Roster. If you wish to create a new pilot, you must first replace an existing pilot. Use your *Controller* to position the cursor on the desired locker. The cursor reads SELECT when positioned over closed lockers and either MEDALS or NEW PILOT if already open.

Press *Selector #1* to open the locker. You are then asked to confirm that you are replacing an existing pilot. Type in the name of your new pilot and press the *Enter Key*. Your new pilot is then given this locker along with a flight helmet. Move the cursor above the lockers and press *Selector #1* when the cursor reads HOME.

SELECTING A PILOT

Because the Pilot Roster allows for more than one Active pilot, you may choose between active pilots by simply moving the cursor over the desired pilot's locker. When the cursor reads SELECT press *Selector #1.* The locker opens indicating this pilot has been selected to fly this particular mission.

ACTIVE PILOTS IN THE ROSTER

All active pilots in the roster retain their accumulated scores. In addition, these pilots keep their current campaign status and Reality Option settings. If not involved in a campaign, pilots remain in the theater where they flew their last mission.

You are not allowed to select MODEM play or enter the BRIEFING Room unless you have an active pilot. The only type of play you can access without an active pilot is Quick Start.

RECOVER PILOT FEATURE

Although we are certain that you will never need to use this feature, a Recover Pilot option has been included. In the unlikely event that your favorite pilot meets an untimely end, you may "bring him back." The Recover feature does not work on Generals or the original seven pilots found in the Roster.

To "recover" an Inactive Pilot, open the locker as you would normally. Press *Selector #1* when the cursor reads NEW PILOT. You are given three menu choices including the Recover Pilot option. Press *Selector #1* over this option.

The pilot is brought back and allowed to continue where he left off. A small medallion is added to the pilot's collection of awards and ribbons to signify that he has been "brought back."

THEATERS

There are three different theaters to choose from; **Persian Gulf (the historical Desert Storm Scenario), Korea, and Central America**. Each theater comes with an accompanying campaign narrative in Chapter 4. To place your missions in their proper context, it is helpful to read the section devoted to your specific theater.

To choose a theater, use your *Controller* to position the cursor over the unfolded map in the foreground of the Home screen. When the cursor reads THEATERS, press *Selector #1.*

You are then shown a world map outlining your three theater choices. Choose the theater by moving the cursor inside the theater box and pressing *Selector #1.* After deciding whether this is to be a single mission or full campaign you are returned automatically to the Home screen.

If you choose to fly missions as part of a campaign, press *Selector #1* on the button marked CAMPAIGN. After you are returned to the Home screen, press *Selector #1* over the unfolded campaign map. You are shown a close-up map of your theater along with an option of aborting the campaign. You are also given a brief report on the progress of your campaign.

REALITY

To access the Reality Panel, move your *Controller* to position the cursor on the brown stone building in the background. When the cursor reads REALITY, press *Selector #1.*

DIFFICULTY LEVELS

You have a choice of four **Difficulty Levels** (1-*easiest* through 4- *most difficult*). The Difficulty Levels represent a number of things: enemy pilot skill level, how quickly you are detected by enemy radar, the number of enemy planes stationed at each airbase, etc. As you increase the level of difficulty, the enemy response becomes tougher. At level 4, only their best pilots are scrambled and the SAMs are formidable.

REALITY OPTIONS

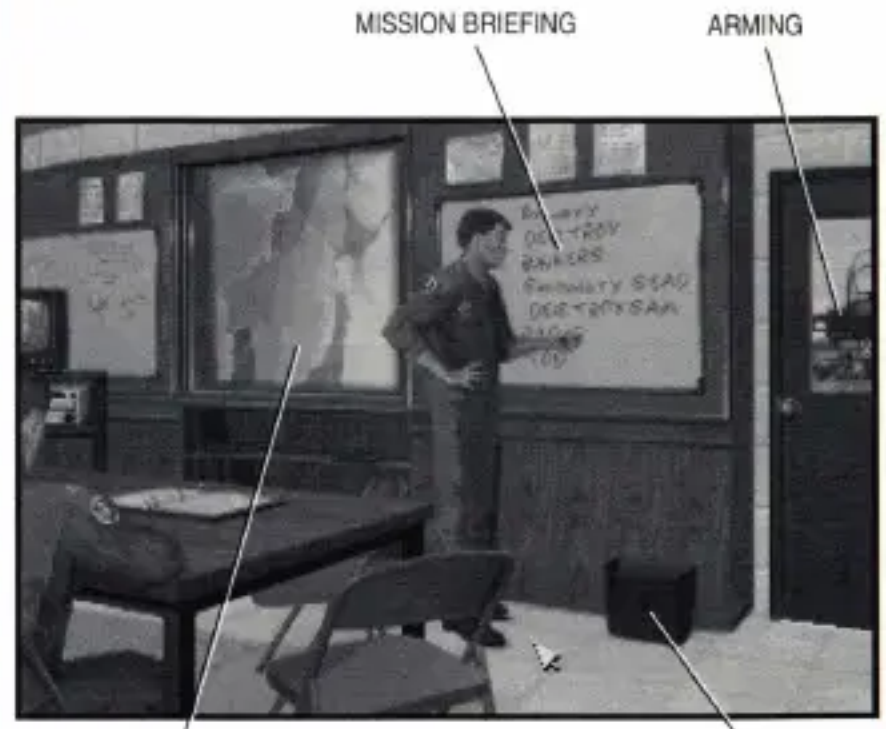
There are twelve reality options which a player is asked to set prior to play. Reality options are set independent of the others so that is possible to have a mix of *Standard Mode* and A*uthentic Mode* features. Some options are set by turning them either On or Off. It is recommended that players experiment with *Standard Mode* first. Once *Standard Mode* has been mastered, build on that knowledge base by setting more and more options to *Authentic Mode.*

The Difficulty Level also affects the default settings of the Reality options. The more difficult the level, the more options are defaulted to *Authentic Mode.* Note that these default settings are recommended settings only. You are not required to keep these settings after choosing a Difficulty Level. In fact, you can change any or all of the default settings without changing the overall Difficulty Level.

Use your *Controller* to move the cursor over the window displaying your option choices. Press *Selector #1* to change the default selection on each of the windows.

If you need help making a decision, you can press *Selector #1* over the name of each Reality option. A short summary or description is accessed to aid you in making an informed choice.

BRIEFING ROOM



BRIEFING

Once you have accessed an active pilot, the next step is receive your mission assignment in the Briefing Room. To enter the Briefing Room, use your *Controller* to position the cursor over the door located on the left wall of the Hangar area. This is the Briefing room door. When the cursor reads BRIEFING press *Selector #1* to enter.

Once inside the Briefing Room, you receive a mission summary which defines the mission you are about to fly. Move your cursor to the white chalkboard. When the cursor reads MISSION, press *Selector #1.* A close-up view of the white chalkboard now gives you a detailed overview of the mission.

At the top of the chalkboard is your flight's call-sign which is used for identification purposes. Note that unlike your Tactical Call-Sign which you gave yourself on the ROSTER screen, you do not chose mission call-signs. These are generated at the start of each flight by "ground-weenies" on the Headquarters staff.

Next, your Primary and Secondary targets are listed according to type of target and location. It is important to pay close attention to the types of targets you are ordered to hit. Target type plays a crucial role in determining the ordnance you will carry if playing with Authen*tic Mode* weapon effectiveness.

Following the target summary comes a listing of additional friendly assets on station. These assets are essentially on-call to help you accomplish your mission. The listing for the Boeing E-3 Sentry AWACS (Airborne Warning and Control System) states the availability and general location of these aircraft.

The listing for the Boeing E-8C J-STARS (Joint Surveillance and Target Attack Radar System) states the availability and general location of these aircraft. J-STARS is used to detect ground movement in the battle area and is responsible for processing real-time intelligence. If conditions change in your target areas you can expect a call from the J-STARS. You may be redirected to strike different targets as a result of the fluid nature of modern war.

The Intelligence Report is a brief summary of the enemy forces you may encounter en route to the target. As with all military intelligence, the report is only an estimate based on information available when you takeoff. These reports may or may not be accurate when you arrive in the battle area.

The next piece of information in your mission orders is a cursory weather report. The sky is either Clear or Overcast and based to a large degree on the theater you are flying in. If a cloud layer exists, you are given the **Cloud ceiling** (altitude of the cloud layer bottom).

Your default Ordnance Loadout is listed along with weapon systems that are currently unavailable (for Campaign missions only).

Lastly, under Force Coordination are Ingress and Egress options. Various start-up times and fuel considerations are listed in the mission orders. On a typical mission, the Pilot and WSO arrive at their aircraft 50 minutes before the actual start of a mission. This allows them time to do their pre-flight checks and walk-around inspections. Thirty minutes prior to mission the crew enters the aircraft. They begin to taxi 15 minutes later.

As part of the Force Coordination considerations, the mission orders list the names and locations of the home airbase or tanker track. Alternate landing areas are noted in case of emergencies.

MISSION MAP

To the left of the white chalkboard is the Mission Map. Move your *Controller* to position the cursor over the map. When the cursor reads MISSION MAP, press *Selector #1*. The Mission Map allows you an up-close inspection of the theater. Use this time to plan your Ingress and Egress routes.

The television shows you video pictures of your targets.

DECLINING A MISSION

If for any reason you wish to decline a particular mission, position the cursor over the trash can. When the cursor reads DECLINE MISSION, press *Selector #1*. The mission is declined and you are returned to the Home screen. Remember, declining too many combat missions may adversely affect your career progression.

ARMING

After having accepted a mission, you must now arm your aircraft or fly with a default load of ordnance. From the Briefing Room, proceed to the Arming Screen by positioning the cursor over the Briefing Room door and pressing *Selector #1*.

The Arming Screen allows you to customize your weapon load or fly with the default ordnance already shown on the aircraft. The default selection is made up for you should you choose to fly the aircraft as is. To accept this default load, simply move the *Controller* over the open cockpit. When the cursor reads TAKE OFF, press *Selector #1* .

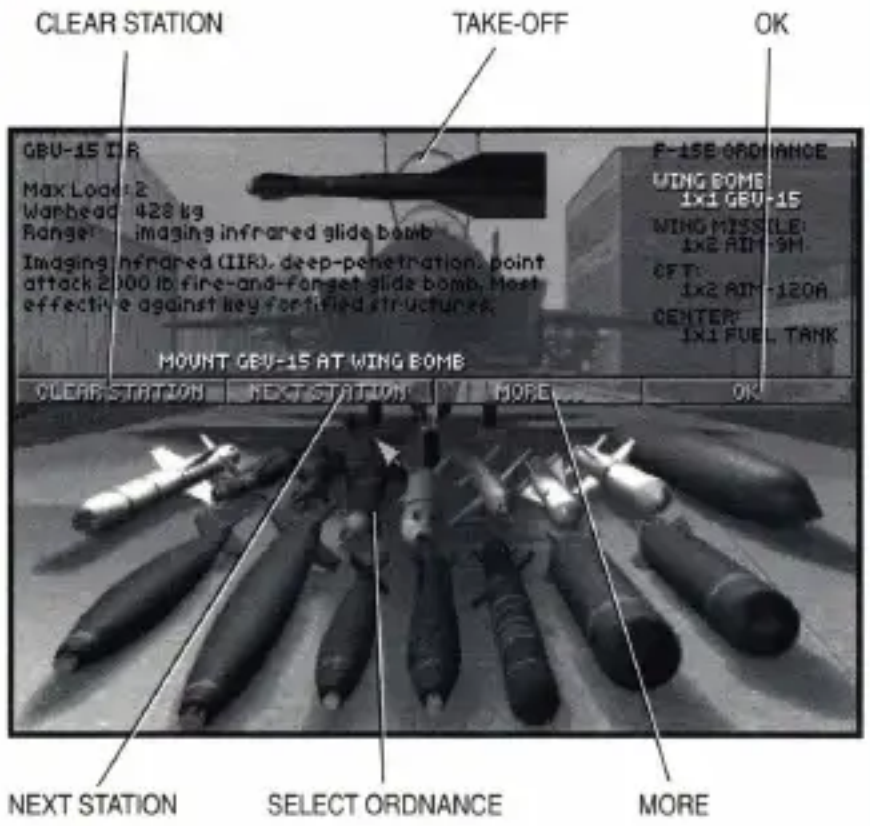
Should you choose to arm the aircraft yourself, take note of the different weapon systems laid out in front of the aircraft. In time, you will come to recognize each weapon on sight, but for now an information window appears describing each weapon when selected.

The F-15E has four ordnance stations located underneath the aircraft; **Wing-bomb, Wing-missile, Conformal Fuel Tank (CFT), and Centerline**. You may arm each of these stations in turn by selecting from a number of different weapon options. Weapons are loaded symmetrically on each wing. That is, the same type of bomb is instantly loaded on both wings to maintain aerodynamic balance.

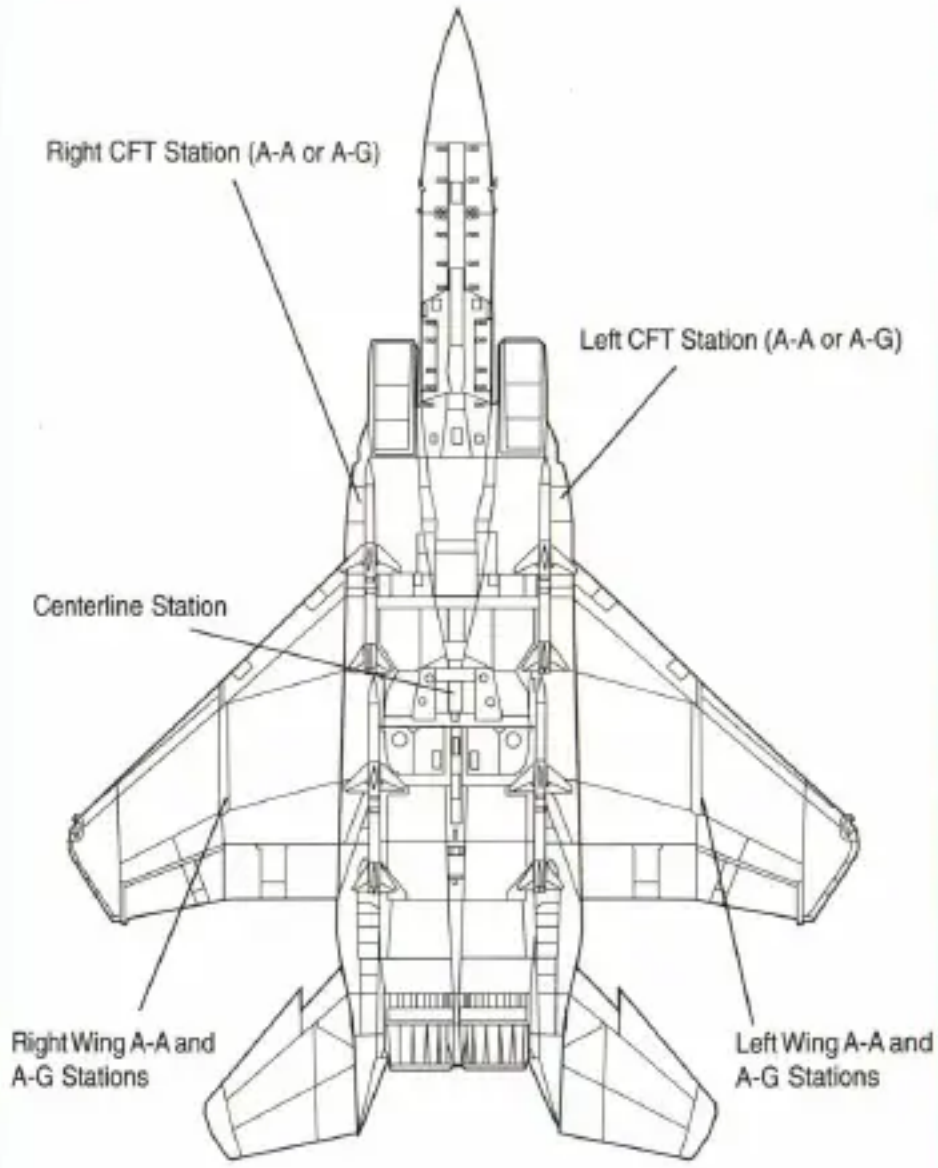
Note that the GBU-15 weapon requires an AN/AXQ-14 data link pod to operate. A data link pod is automatically loaded on your Centerline station when this weapon is selected.

To arm your aircraft simply press *Selector #1* when your cursor is overtop the desired weapon. The current station being fitted is highlighted on the menu. Pressing *Selector #1* when your cursor is not overtop of a weapon brings up the Information Panels.

ARMING SCREEN



F-15E, BOTTOM VIEW OF LOAD-OUT


Right CFT Station (A-A or A-G)
Left CFT Station (A-A or A-G)
Centerline Station
Right Wing A-A and A-G Stations
Left Wing A-A and A-G Stations

After being selected, the weapon is automatically placed on the highlighted station. The current load of each station may be viewed in the upper right corner of the arming screen. The numbers to the left of the weapon's numerical designation (1 x 1, 2 x 3, 3 x 2 etc.) refer to the amount of weapons that are released by a single press of the Pickle Button. For

example, the numbers 3 x 2 indicate that 3 weapons are released at a time and that the pilot may make two drops. The total number of weapons loaded on this station therefore equals 6.

You are automatically moved to the next weapon station. You may also advance to the next station by pressing *Selector #1* on the panel marked NEXT STATION.

Since weight affects your performance you may wish to lighten the load by having a station remain empty. If this is the case, press CLEAR STATION when the desired station is highlighted. For example, short range missions may not require a centerline external fuel tank.

The panel marked MORE accesses an F-15 under-belly schematic which shows the weapons stations while being loaded. This schematic appears in the upper right corner of the screen after pressing *Selector #1* on the panel.

When you are satisfied with your ordnance selections, move your *Controller* to the panel marked **OK** and press *Selector #1*. The information panels are erased from the screen in order that you may view the aircraft fully loaded with ordnance. Use your *Controller* to position the cursor over the Cockpit canopy. After the cursor reads TAKE OFF, press *Selector #1* to go immediately to the flight line for takeoff.

Pressing *Escape* (esc Key) returns you to the Briefing Room at any time.

MODEM

F-15 Strike Eagle III gives you the ability to fly the aircraft with or against another person in real time by using a modem link. This link can either be made telephonically or by a direct connect between two computers. There are three different styles of Modem play for you and a friend to choose from; **Cooperative Wingman**, **Co-operative Front Seat/Back Seat** and **Head-to-Head Competition**. Specific details concerning Modem play can be found in the Technical Supplement which accompanies this simulation.

MENU BAR OPTIONS

The Home Screen Menu Bar is located at the top of the Home Screen. You may access the Menu Bar by moving your *Controller* and positioning the cursor at any point along the top edge. When the cursor reads MENU, press *Selector #1*.

MODEM

The Home Screen Menu bar is used to set up Modem play. Follow the on-screen prompts and configure the Modem options to accomodate your hardware.

FILE

You are given the option to Quit to DOS should you desire. If you access the panel marked About F-15 III, you are treated to a photo of the entire design team (suitable for framing).

IV. YOUR CAREER

When you place a new pilot on the Pilot Roster, you are beginning that individual's service career. In essence, you become this pilot. While each combat mission is an opportunity for advancement, there also remains the inherent risk of not coming back. From this point on, your decisions concerning accepting or declining missions reflect how far you will progress with this particular pilot.

Before beginning each mission, you are given Primary and Secondary targets to attack. Your objective is to destroy these two targets and make it back safely. Along the way you are likely to encounter stiff enemy resistance in the form of interceptor aircraft, SAMs, and Triple-A.

MISSION SCORING

Destroying both the Primary and Secondary targets gives you the best opportunity for maximizing your score. You may, however, destroy enemy targets of opportunity as they present themselves. Destroying enemy ground installations such as SAM radars, oil storage facilities, runways, and missile boats, add to your total score. But, remember that your primary and secondary targets must take priority.

After each successful mission, you receive a point score depending upon how well you performed. Destroying enemy targets raises your point score but you must be careful to avoid causing collateral damage or civilian casualties. This may significantly lower your final score, not to mention the explaining you'll have to do upon your return.

PROMOTIONS

Promotions are based upon your accumulated point totals. They are not easy to get but they do come in time. Every pilot starts out a flight career as a 2nd Lieutenant. Based upon your accumulated point total, you may be promoted to 1st Lieutenant. As you add more points to your total score, you are promoted up through the ranks as follows; Captain, Major, Lieutenant Colonel, and Colonel.

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The highest and final rung on the career ladder is Brigadier General. Having reached this lofty position of responsibility, the Air Force ceremoniously retires you to a Pentagon desk job. Of course having been assigned to a desk, you are in a wonderful position to seek fame and fortune as a civilian lobbyist working on Capitol Hill.

AWARDS AND MEDALS

You may also receive awards and medals for outstanding performance during the course of any one particular mission. All awards and medals are kept in your personal box of decorations. This box is stored on the top shelf of your individual locker. Awards and medals stay with the pilot even if missions are flown in different theaters. They are non-transferable between pilots.

Each of the three theaters has its own separate campaign ribbon for successfully completing a campaign. Other awards (ranked lowest to highest in value) include the Air Force Commendation Medal, Air Medal, Distinguished Flying Cross, Silver Star, Air Force Cross, and Congressional Medal of Honor. Of course, there is always the Purple Heart for becoming wounded in the line of duty.

If you awarded more than one of a specific decoration, you receive a cluster instead of the actual decoration. Bronze clusters signify the receipt of each additional award up to five. Silver clusters indicate that you have been awarded that particular decoration five additional times. For example, if you possess an Air Medal with Silver cluster, this indicates that you have been awarded the Air Medal a total of six times.

ENDING YOUR CAREER

BECOMING A CASUALTY

Your career is over, obviously, if you become KIA (Killed In Action). Getting killed is an occupational hazard which can occur a number of different ways. Crashing or flying into the ground tends to be fatal. Bailing out at speeds over 400 knots is generally a career ending move as well.

RETIRED FOR THE GOOD OF THE SERVICE

If you bail out of your aircraft too many times, the Air Force declares you unfit for duty. If this happens, you are retired for the good of the service and finished flying F-15s. Turn in your wings, because your career is over.

ENDING A MISSION

Once in flight there are several ways to end your current mission if you so choose. The first two options are completely voluntary. The remaining options are left up to the whims of fate.

QUIT TO DOS

Press the **Quit to DOS (alt q Key)** or use the Menu bar prompt. Ending the mission in this manner does not give you credit for any points you may have scored prior to leaving. This option may be exercised at any time during play.

ABORTING A MISSION

Use the Menu bar prompt to abort the mission. Ending the mission in this manner does not give you credit for any points you may have scored prior to leaving. Aborting the mission returns you immediately to the Home Screen where you are free to begin a new mission. This option may also be exercised at any time during play.

END MISSION OPTION

If you desire, you may prematurely end the mission voluntarily by selecting the END MISSION option from the "in flight" Menu bar. In order to do this, your aircraft must be "Fence Out," i.e. out of enemy controlled airspace. Note that the penalty for ending the mission in this manner is a slightly reduced point score.

CRASHING

Crashing into the ground has a tendency to end your mission. You want to avoid this whenever possible. No doubt there will be times in the heat of combat where your attention is focused on other things. Try not to lose sight of the ground when maneuvering. If you see that a crash is inevitable, by all means eject.

GETTING SHOT DOWN

One of the drawbacks to combat is that occasionally the enemy gets lucky and manages to shoot down your aircraft. Fortunately, rescue aircraft and helicopters are constantly airborne waiting for just such an occurrence. If your aircraft is no longer airworthy, eject and wait to be picked up. Even if you are behind enemy lines, in most cases you will be successfully rescued.

SAFE LANDING OR RETURN

A successful mission ends with the return of your aircraft to a friendly airbase or tanker track. Once you have received a SAFE LANDING from the control tower, you are taken directly to the Debriefing room to recap the mission. The KC-10 Tanker crew can be counted on to give a cheery "WELCOME HOME" greeting.

MISSION DEBRIEFING

The Mission Debriefing consists of an animated replay of your mission. This animation shows the major events which took place and places them in chronological order. A summary of your point score is also displayed along with any medals or awards you are to receive. At the conclusion of the Debriefing, you are taken directly to the Home Screen.

CAMPAIGN MISSIONS

A Campaign is considered to be a series of consecutive missions all flown by the same pilot in the same theater. Each mission also has you taking off from the same base.

A campaign game mission is "won" or "lost" individually. A pilot "wins" a mission if he/she successful destroys either the Primary or Secondary target. Destroying both targets is better in terms of overall point score, but only one is required to "win" the mission.

You are not required to make it back to a friendly airbase or tanker track in order for the mission to be counted as a "win." You may bail out of a damaged aircraft and still consider the mission successful as long as either target was destroyed. Keep in mind that bailing out too often may cause you to be assigned a desk job.

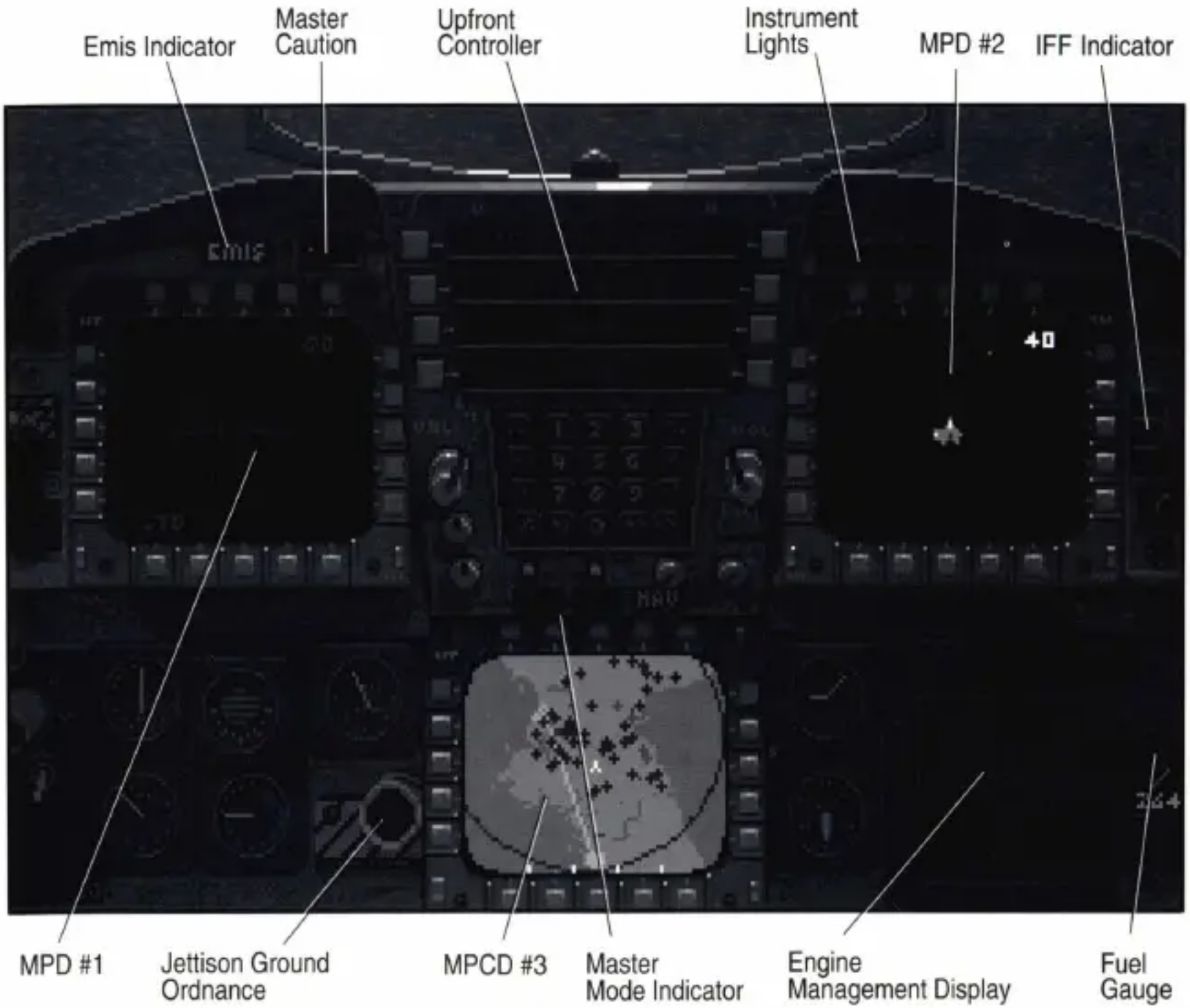
Each mission is part of a larger campaign goal. Consider them as "stepping stones" toward an achieving a greater objective. For example, a campaign may have as its ultimate goal the elimination of all enemy naval traffic in a certain body of water. A series of campaign missions would then be generated directing you to strike these targets. The final goal might be an attack on the port facilities supplying these vessels. Your campaign would progress toward victory as these targets were eliminated.

Once a pilot undertakes a campaign, that pilot may only fly missions as part of the on-going campaign. For example, a pilot may not begin a Persian Gulf campaign then fly single missions in that theater. Likewise, a pilot with a campaign underway may not switch theaters to fly missions elsewhere.

The only way a pilot may exit from a campaign is by choosing to abort the campaign before it has reached a conclusion. The option to abort the campaign is offered on the Home Screen before each flight.

Upon successful completion of the entire campaign, a pilot is awarded a campaign ribbon from the appropriate theater. You are now free to assign the pilot to a new campaign in this, or any other theater. You may choose to forego further campaign game missions and have the pilot fly single missions for awhile.

FRONT SEAT COCKPIT



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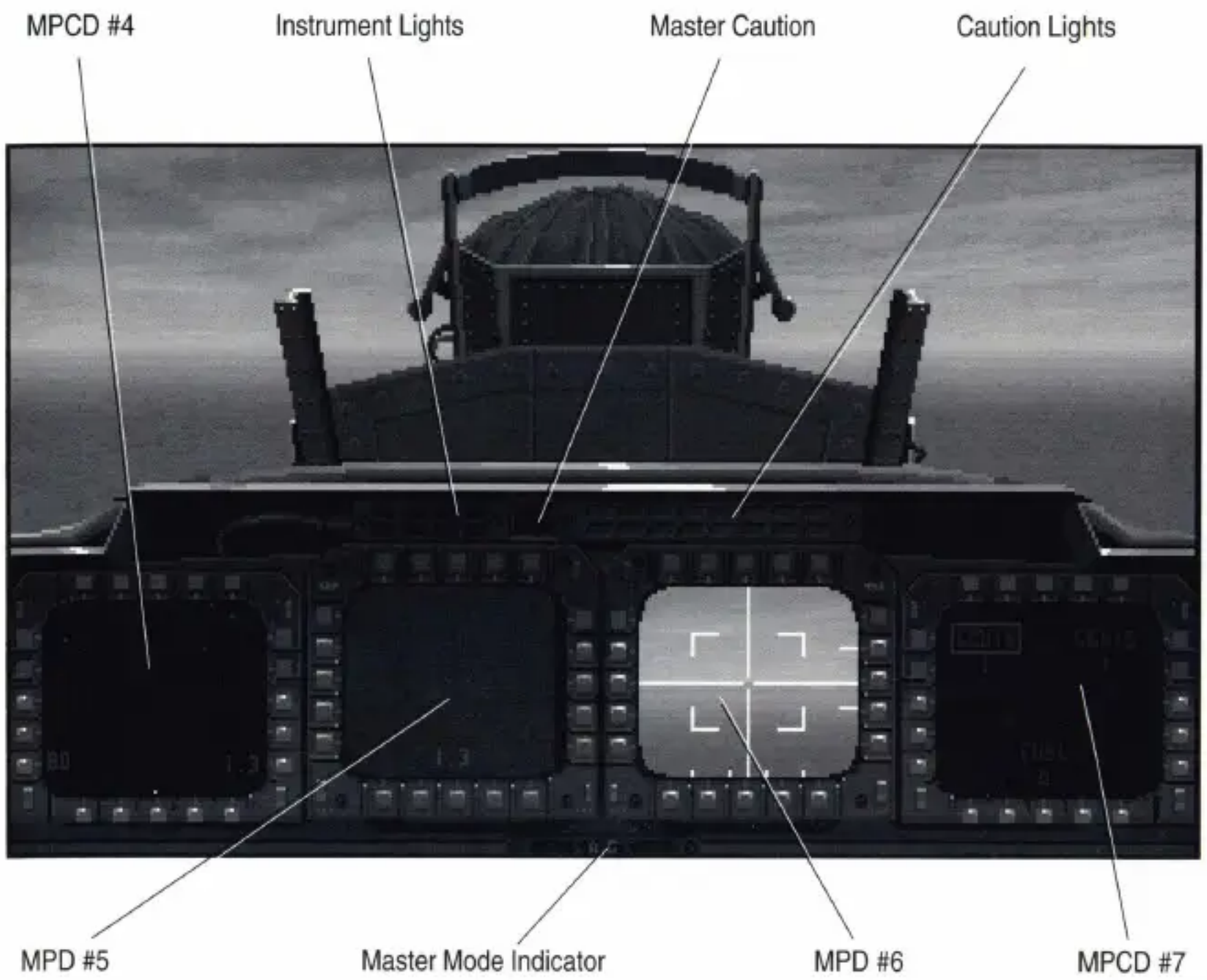
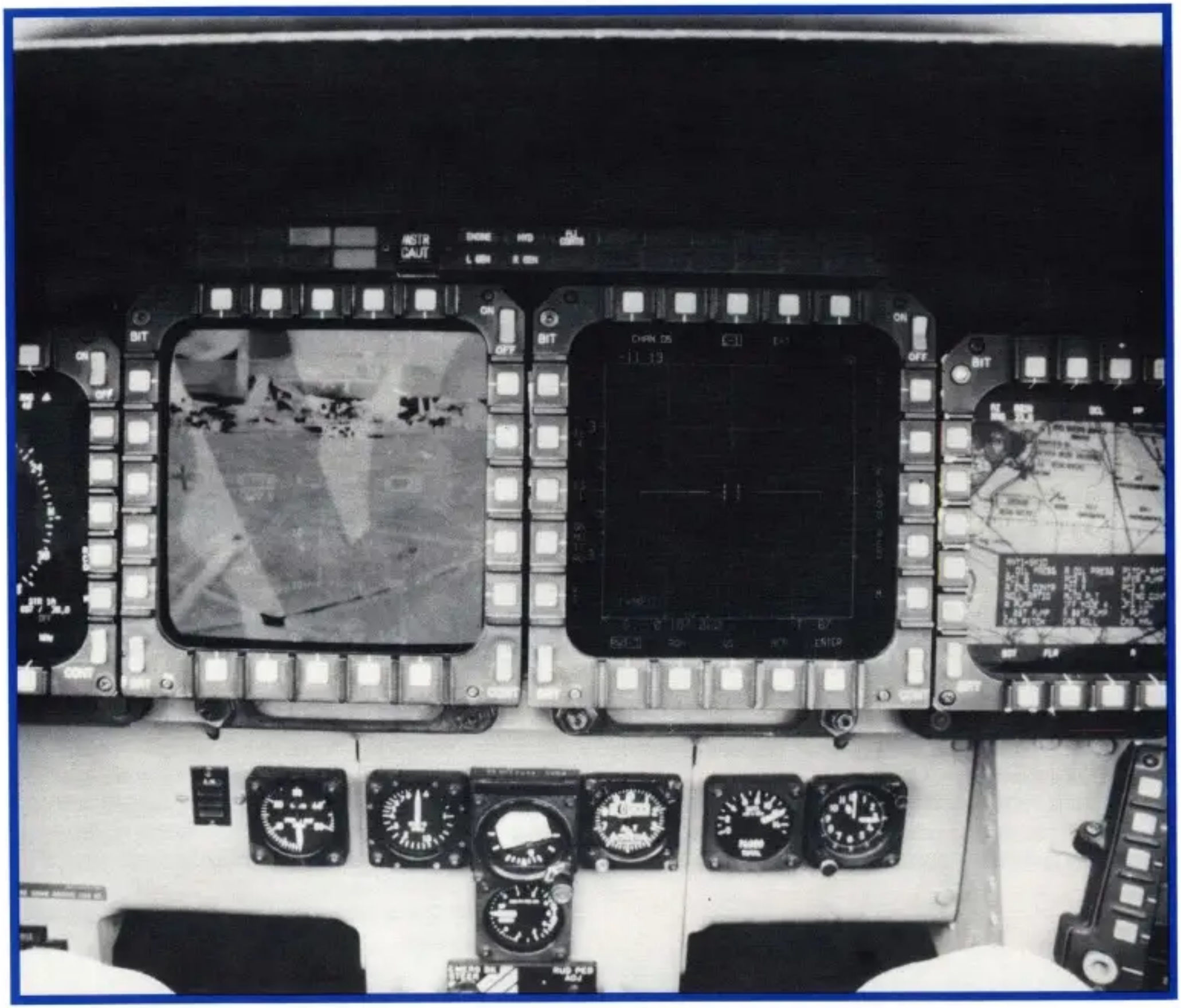
REAR SEAT COCKPIT





Hans Halberstadt/Arms Communication

V. HOW TO FLY

THE F-15E COCKPIT

Since the F-15E is a two-seat strike aircraft, there are two areas of primary flight control: the front Pilot's seat and rear Weapon Systems Officer's seat. From these two positions you are able to both fly the aircraft and utilize its weapon systems.

THE FRONT SEAT (PILOT'S STATION)

The front seat of the F-15 III is reserved for the pilot of the aircraft. Directly in front of pilot's field of vision is located the cockpit "dash" and *Head-Up Display* or *HUD*. The HUD is a transparent screen containing superimposed flight information which also gives the pilot an unobstructed view out the front of the aircraft.

Underneath the HUD is the aircraft's front seat "dashboard." It contains three primary areas of activity, the MPD/MPCDs, Upfront Controller, and Engine Management Display.

The Pilot has access to two ***Multi-Purpose Displays* (MPDs)** and one ***Multi-Purpose Color Display* (MPCD)** from the front seat position. Before flying, look at the section on MPDs and MPCDs to get familiar with the various display screens.

Located between the two MPDs is the **Upfront Controller**. The Upfront Controller consists of four text strips which may be toggled to display Primary and Secondary target information. Additional fuel and navigational information is available by pressing ***Upfront Controller* (u Key)** during the course of the flight.

Located just to the right of the lower MPCD is the Engine Management Display. You are able to monitor the status of your engines at a glance simply by viewing this display.

THE REAR SEAT (WEAPON SYSTEMS OFFICER'S STATION)

The rear seat is not equipped with a HUD although there is a HUD repeater display available. Instead, as the "Weapon Systems Officer or Wizzo," you get to look at the back of the pilot's head for the duration of the mission. Usually, there is little time for that, however. As the Weapon Systems Officer, you are kept very busy working two MPDs and two MPCDs.

These displays operate exactly as those in the front seat. Although you can conceivably launch ordnance as well as fly from the pilot's seat, that is the pilot's job. The job of the Weapon System Officer (WSO) is to set up the shot for the pilot. It is always a good idea to have the Weapon Systems Officer periodically use the ***Rear View* (F3 Key)** to check your "six."

COCKPIT INSTRUMENTATION AND CAUTION LIGHTS

The Front and Rear Cockpits are equipped with a number of Instrument and Caution lights. Instrumentation lights act as visual indicators that a certain event has taken place or that a particular piece of equipment is operating. Caution lights are visual indications of damage sustained by your aircraft.

FRONT SEAT INSTRUMENT/CAUTION LIGHTS

Located over Multi-purpose Display #1 are two lights: the **EMIS** and **Master Caution (MC)** indicators. The EMIS light illuminates when your aircraft is emitting detectable energy from either your radar or internal Jammer. The Master Caution light illuminates only after the aircraft has suffered damage. The MC light does not indicate the specific nature of the damage, only that it has occurred.

The Front Seat instrument lights are located over Multi-Purpose Display #2 as follows:

[AI] Airborne Intercept: This light illuminates when an enemy aircraft has fired an air-to-air missile at your aircraft.

[S] SAM: This light illuminates when a SAM launch is detected by your TEWS.

[A] Automatic Pilot: This light illuminates whenever the automatic pilot is engaged.

[B] Brake: This light illuminates whenever the ground brakes are applied or speedbrake extended while in flight.

[G] Landing Gear: This light illuminates when your Landing Gear is extended for takeoff and landings.

[J] Jammer Activated: This light illuminates when your internal jammer is activated. This does not mean that it's currently functioning, only that it has been activated.

Located directly to the right of MPD #2 are two additional instrument lights:

[I] Identification; Friend or Foe: The IFF light illuminates when a friendly aircraft is locked on radar and has been identified by IFF.

[L] Running Lights: This light is illuminated when Running Lights are turned on.

REAR SEAT INSTRUMENT/CAUTION LIGHTS

The Rear Seat instrument lights are located over Multi-Purpose Display #5. They provide duplicate indications of the lighting available to the pilot in the front seat.

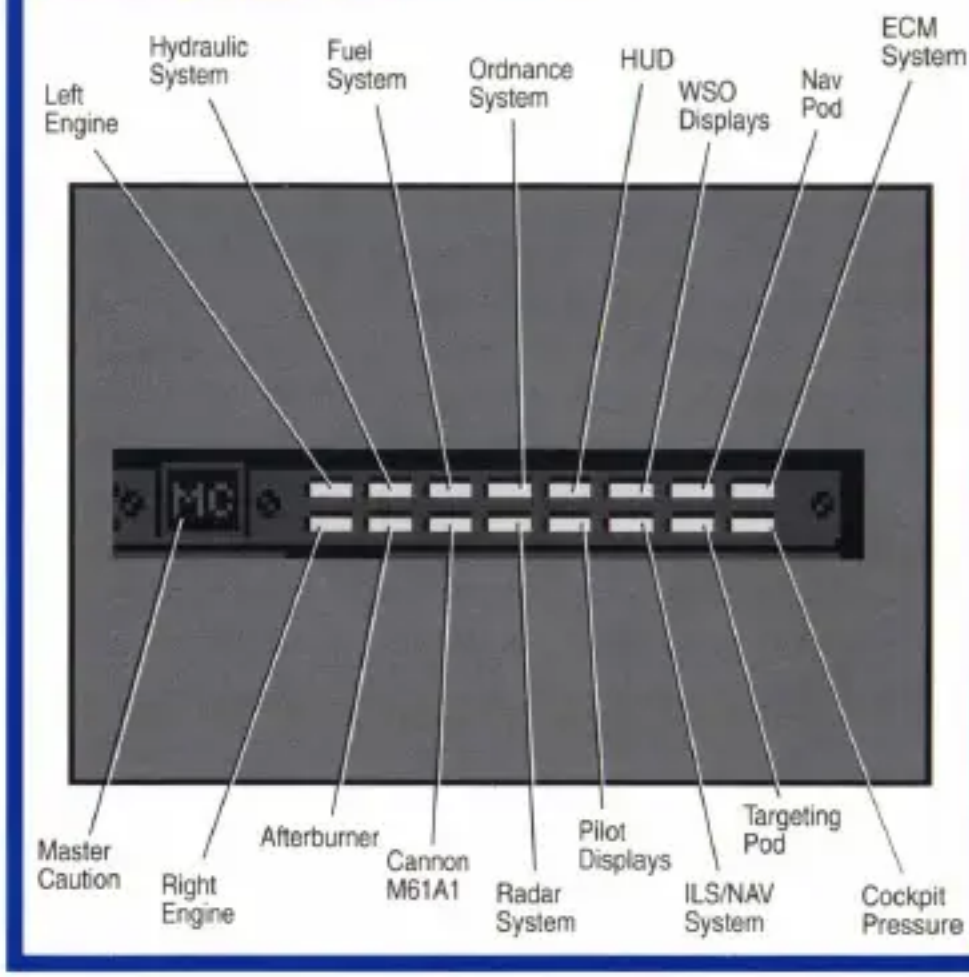
There are sixteen Caution lights arranged in two rows of eight, located over MPCD #6. Each of these lights corresponds to various items on the aircraft that are susceptible to damage. When these items are damaged, the appropriate Caution light illuminates (refer to the Damage section for details).

FLIGHT CONTROLS

THE CONTROLLER

F-15 Strike Eagle III is able to accommodate a number of different flight control options. Your *Controller* represents the control stick on the actual aircraft. It is the principal means of guiding your aircraft through the air. In the simulation it may be either a physical joystick, numeric/cursor keypad, or some other device (see the Technical Supplement for details).

REAR SEAT CAUTION LIGHTS



Note that if a mouse device is available, it is active along with the Controller. Both come into play at various times during a mission.

Note that the more you move the *Controller*, the more your aircraft pitches or rolls in that direction. When you release the stick (or stop pressing keys), the aircraft gradually returns to a wings level attitude.

Your *Controller* mimics the standard aircraft control stick. Pushing the stick forward and away from you pitches the nose of the aircraft down. Pulling the stick back and toward you pitches the nose up. Moving the stick left or right, banks the aircraft in that direction.

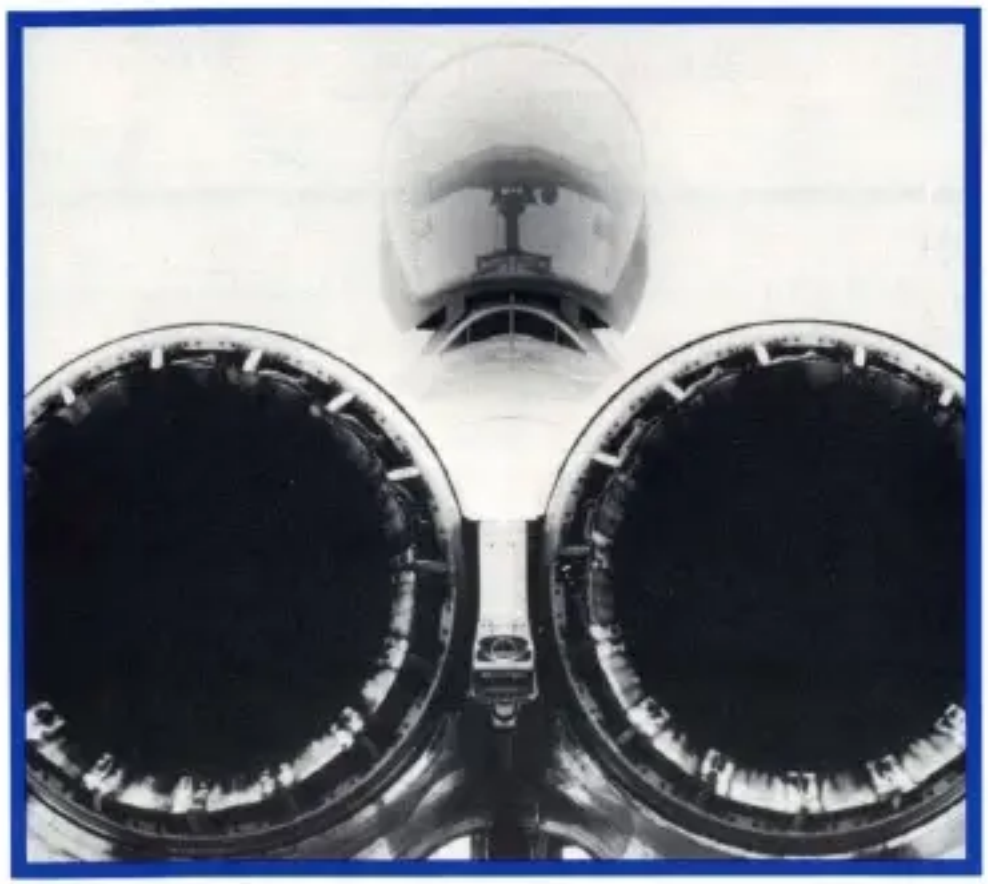
A hint to first-time flyers: use a light touch on the *Controller*. The most common pilot error is a "ham-fist" on the stick, throwing the aircraft around the sky in uncontrolled abandon. Only emergencies should cause you to "peg" your stick (push it up against the stoppers, beyond which it cannot move).

THE THROTTLE

The throttle controls the power output of your engines. In *F-15 Strike Eagle III* you operate the throttle setting by pressing ***Accelerate* (= Key)** or ***Decelerate* (- Key)**. Each time you press one of these keys, your throttle is either increased or decreased incrementally. Note that you can ***Max Accelerate* (shft= Key)** or ***Cut Throttle* (shft- Key)** instantly. The throttle setting for normal cruising speed is 86-90% power. Full Military Power is 100% power and uses fuel at a faster rate.

If additional power is needed to escape a dogfight or perform an extended vertical climb, press ***Afterburner* (a key)**. The Afterburner dumps raw fuel into the engines and adds an additional 10% to Full Military Power output (110%). In fighter-speak, flying with your afterburner lit is known as travelling at the "speed of heat."

Fuel is consumed at an enormous rate, however. Afterburner cannot be sustained for long without running out of fuel long before the mission has been completed.



Hans Halberstadt/Arms Communication

To turn off the afterburner, simply press ***Decelerate* (- Key)** once. The afterburner is automatically shut off. If you're not sure if the afterburner is shut down, check the status of your engines on the Engine Management Display. When the afterburner is engaged the RPM% indicator reads 110%.

THE ENGINES

The original engine design used on the A and B model F-15s came from specs outlined in the early FX program. In 1970, the USAF settled on two Pratt & Whitney F100-PW-100 afterburning turbofans. These engines were subjected to a 150 hour nonstop test which included 30 hours of continuous operation simulating Mach 2.3. By October 1973, the DOD finally authorized full funding for the project.

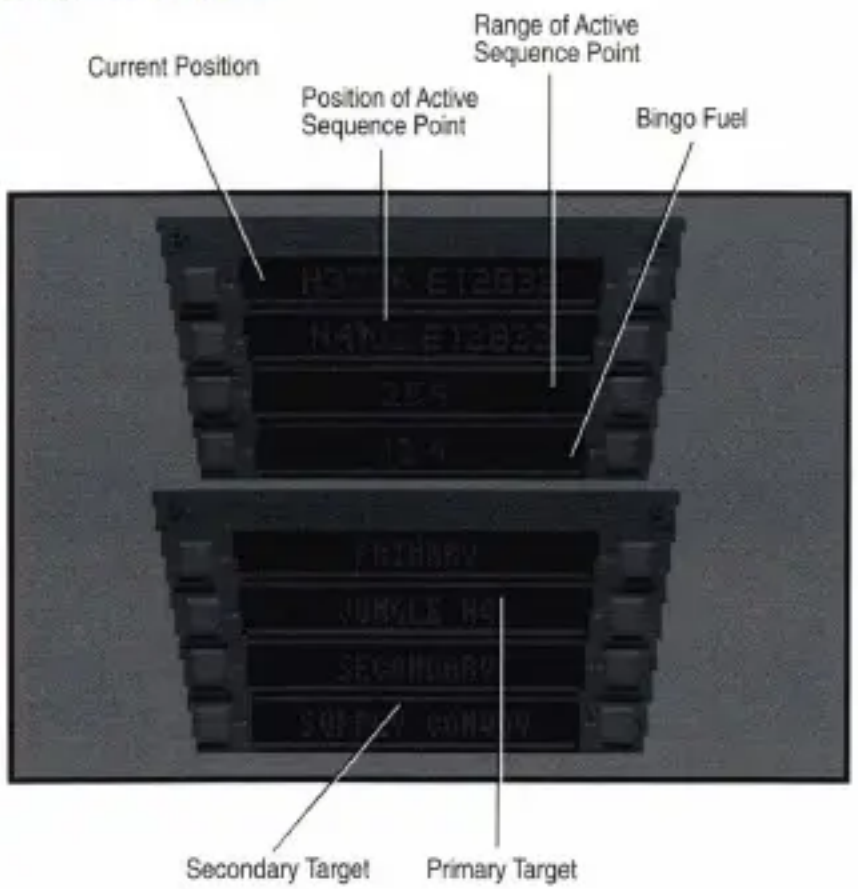
The F100 design was subsequently upgraded with a digital electronic control system. Renamed PW-220, the digital controls significantly enhanced the engine's performance. The maximum engine output with afterburner (28,900 lbs. of thrust) could now be reached in under five seconds. F-15Es built from 1986 through 1990 were originally fitted with F100-PW-220 series engines.

From 1990 on, the F100-PW-229 series engines have been fitted to newer block F-15 models. These engines provide greater thrust and perform better at high altitudes than the PW-220. The PW-229 compressor is also more reliable leading to a lowered incidence of compressor stall. All F-15Es flown in *F-15 Strike Eagle III* are considered to be equipped with F100-PW-229 engines.

UPFRONT CONTROLLER

The Upfront Controller consists of four text windows located directly underneath your HUD. The information displayed inside these windows is designed to help you navigate the aircraft.

UPFRONT CONTROLLER



On the top line, the **current position of your aircraft** is displayed alpha-numerically. Your position is given in degrees and minutes according to the aircraft's latitude and longitude. The letter prefix corresponds to the compass headings (North, South, East, and West).

DETERMINING YOUR LAT/LONG POSITION

The theater maps provided with each scenario contain latitude and longitude lines corresponding to the positions indicated on the Upfront Controller. To pinpoint your location on the map at any given time, simply cross index your latitudinal (horizontal lines) and longitudinal (vertical lines) positions.

The first two digits are degrees of latitude. The final two digits are minutes of latitude. A minute is equal to roughly one nautical mile. On maps of this size, minutes of latitude and longitude are hard to distinguish. They can be ignored without affecting the accuracy of this process.

Trace your finger across the proper latitude line until reaching the point matching the degrees indicated. Repeat this procedure on the proper longitude line. The intersection of these two points is your current location. Note that degrees of longitude may consist of three digits.

All of the theater maps are divided into 3 degree increments of latitude and 5 degree increments of longitude. The rectangles formed by these divisions are all uniform. Any distortion you perceive between the rectangles is due to the process of projecting a globe onto paper.

The second line displays the **position of your active Sequence Point** in the same lat/long manner. The third line displays the **range in nautical miles** to the active Sequence Point.

The last line calculates the **minimum fuel** required to fly from the Sequence Point furthest from your home airbase or tanker track, back home. This figure is known as **Bingo fuel**. When the Bingo fuel amount figure reaches your remaining on-board fuel plus reserve, you are alerted. If you consume more fuel than is needed to return, plan on an alternate landing site or "punching out" after running out of fuel.

ENGINE MANAGEMENT DISPLAY

ENGINE MANAGEMENT DISPLAY

The Engine Management Display is located in the lower right-hand corner of the front seat cockpit. In order to view this display you have to press ***Look Down* (/ Key)** first. The EMD is situated directly to the right of your MPCD #3. Viewing the EMD while in flight gives you the ability to instantly monitor the status of your engines, fuel, etc. It is divided into two identical columns, one for each of the aircraft's two engines.

The top number is the current power output expressed in a numerical percentage of total engine RPMs. (Full Military Power is 100%). The next line gives the fuel temperature in degrees Celsius. The third line gives the amount of fuel being consumed. Fuel flow is displayed in pounds (lbs.) of fuel per hour.

The small gauge shows the nozzle position of each engine. The "turkey feathers" at the rear of each engine are opened and closed to maximize the thrust produced at each power setting. The gauge depicts the nozzle position as a single line which moves up or down the display depending upon the power setting of your engines.

The bottom number gives the oil pressure in pounds per square inch (PSI).

HEAD-UP DISPLAY (HUD)

The Head-Up Display (HUD) provides crucial flight and weapon data superimposed on a wide-angle transparent pane in the front of the cockpit. The pilot may look through the HUD to the outside world. As a result, valuable information is right in front of your eyes, where you can keep track of the outside action simultaneously.

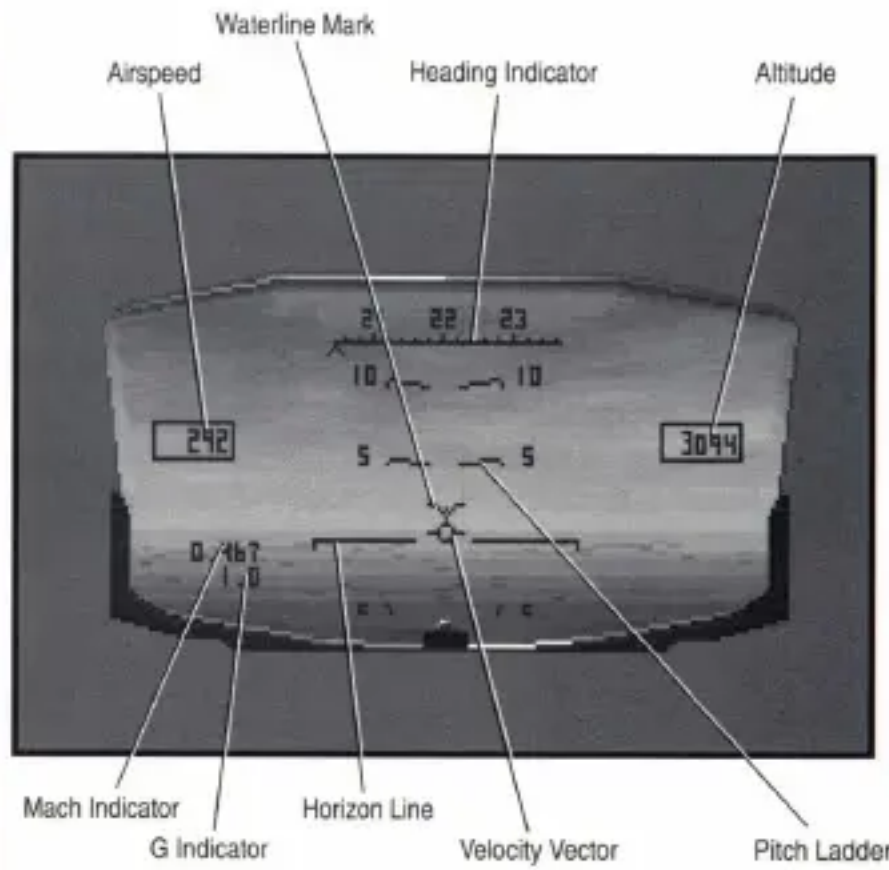
HUD GENERAL INFORMATION

The great majority of information displayed on the HUD is available to you regardless of mode. The following list of information is always displayed:

AIRSPEED

The small rectangle centered on the left side of the HUD indicates your airspeed in knots. When your landing gear is raised, your airspeed Mach number is displayed in the top line of text in the lower left corner of the HUD.

HUD IN NAV MODE



The bottom line of numbers indicates the amount of g-force being exerted. The aircraft can withstand more g-force than the pilot. Human g-force limits average between -3 g and +9 g depending on pilot training and experience.

ALTITUDE

The small rectangle centered on the right side of the HUD indicates your altitude (in feet). Larger-sized digits represent your altitude in thousands of feet, smaller digits represent hundreds of feet. When flying over elevated terrain such as mountain ranges, a radar altimeter automatically displays your Above Ground Level (AGL) altitude as a second number directly underneath your altitude as measured from sea level. The radar AGL number is marked with an "R" prefix. Note the radar altimeter functions independent of your main radar system.

HEADING

Your compass heading (the direction in which you are flying) is indicated on the horizontal line across the top of the HUD. This scale is divided every ten degrees by the large tick marks above the horizontal line. A reading of 12 equals a heading of 120°. A reading of 27 equals a heading of 270°. The heading indicator functions as a normal compass, where 00°=North and 180°=South, 90°=East, and 270°=West.

INS SEQUENCE POINT DIRECTION INDICATOR

An inverted -V symbol (caret) is located on the bottom of the heading indicator's horizontal line. This Sequence Point indicator shows the heading you would need to fly in order to reach the point cued into the Inertial Navigation System (INS). To get on course, maneuver your aircraft until the Sequence Point caret is centered underneath the horizontal scale.

For each mission, your INS is pre-programmed with your primary target, secondary target, and home airbase or tanker track. When set to *Standard Mode* you can cycle the Automatic Pilot through these Sequence Points at any time by toggling ***Sequence Point+*** **(s Key)** or ***Sequence Point-*** **(shft s Key)**. ***Sequence Point+*** advances you to the next INS indicator and ***Sequence Point-*** takes you back to the previous point.

WATERLINE MARK

The **"-W-"** symbol in the center of the HUD represents the direction your aircraft is currently pointing. It also is a fixed indicator of your angle of attack (pitch). Normally, if it is positioned above the horizon you are in climb. In a dive, the Waterline mark would be below the horizon.

VELOCITY VECTOR

The Velocity Vector indicates the aircraft's actual direction of flight based on the relationship between its air speed and angle of attack. Note that there are instances where the Velocity Vector and Waterline Mark are different. This usually occurs immediately after a sudden change in pitch attitude when the Velocity Vector needs time to catch up to the Angle of Attack.

PITCH LADDER

The Pitch ladder appears on the HUD as a series of horizontal lines. Each one of these lines represents 5° of pitch (up or down). If your aircraft is flying level to the horizon, its pitch is said to be 0°. If the aircraft is climbing straight up or diving straight down, the pitch is 90°.

The pitch lines themselves are a major source of information. When the aircraft assumes a nose-up pitch, the lines are solid indicating positive degrees of pitch. When the aircraft assumes a nose-down attitude, the lines are dashed indicating negative degrees of pitch.

The tiny hooks on the ends of the pitch lines always point toward the horizon (level flight). This is helpful when conducting maneuvers where the horizon is not visible. In addition, the pitch lines are also inclined toward the horizon. The degree of inclination is equal to half the actual pitch of the aircraft.

The Bank attitude of the aircraft is indicated by the relative angle of the pitch ladder to the Waterline Mark. If the pitch ladder is perfectly vertical, your craft is level. If the line slants to the left or right, your craft is rolled to the right or left. Note that the aircraft is actually turning opposite of the pitch ladder inclination.

AIRCRAFT MASTER MODES

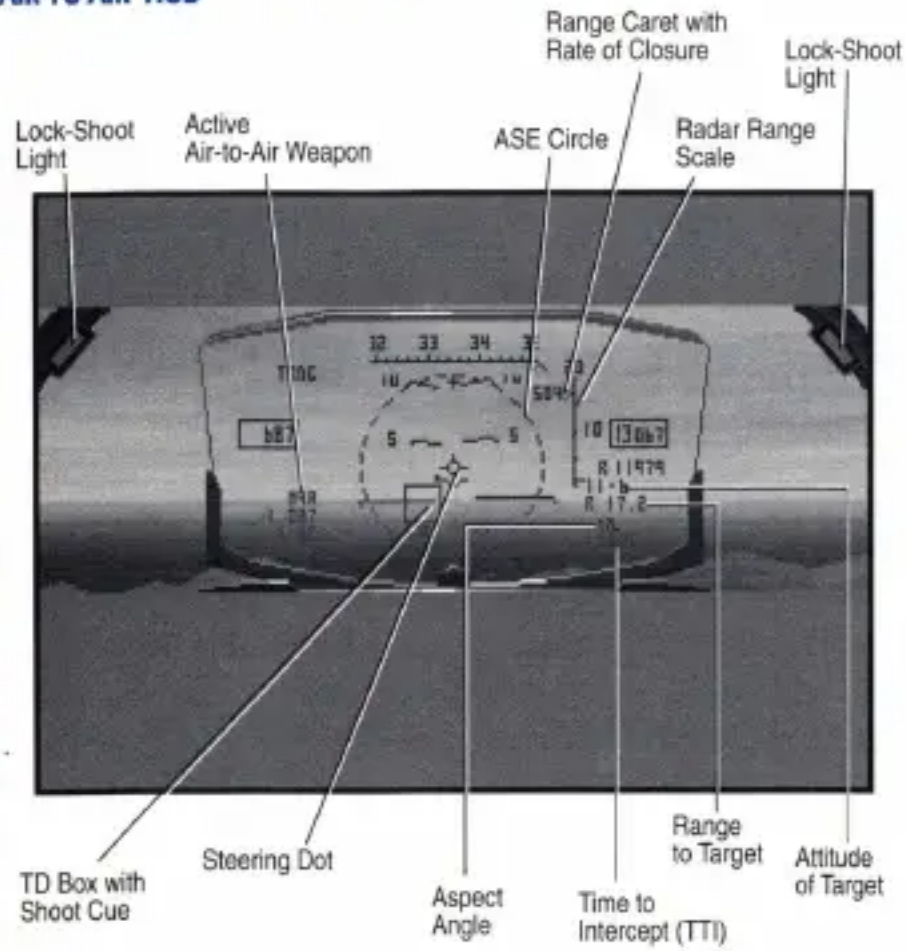
The heart of the F-15E's ability is its radar system. The AN/APG-70 radar makes your aircraft an excellent all-weather strike-fighter. The aircraft has three Master Modes which when selected are then superimposed on your HUD. These Master Modes are **Navigation**, **Air-to-Air**, and **Air-to-Ground**. While some information is universally displayed in all Master Modes, much of the symbology on the HUD is relevant only to a specific mode.

Be certain that you have toggled the aircraft to the correct Master Mode setting. There is nothing more embarrassing than trying to engage enemy aircraft while still displaying Air-to-Ground mode on the HUD.

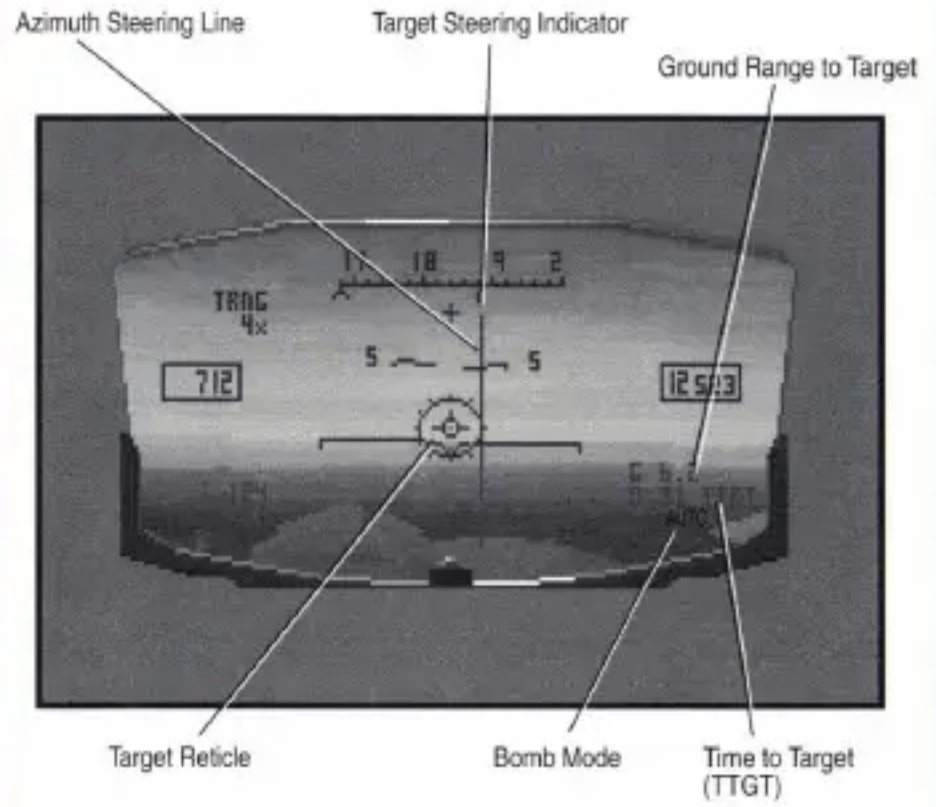
Your current Master Mode is displayed on the instrument panel along the bottom of your cockpit screen. You are able to quickly alternate between modes by toggling the ***Master Mode*** **(m Key)**. You are also able to switch to **AA** or **AG** modes by selecting the appropriate ordnance.

For example, you are flying in toward a ground target preparing to let loose a salvo of Maverick air-to-ground missiles. Your aircraft should be

AIR-TO-AIR HUD



AIR-TO-GROUND HUD



set on the Air-to-Ground Master Mode (AG) so you can spot the target. However, just as you approach the target, the TEWS display alerts you that a nearby enemy aircraft has obtained a "lock" on your aircraft.

To deal with this immediate threat, you quickly change to Air-to-Air Master Mode (AA) by toggling the ***Master Mode* (m Key)**. Your radar is instantly switched from detecting ground targets and now is able to pick out enemy aircraft. After dealing with the enemy interceptor, you change back to Air-to-Ground Mode and launch your Mavericks. Mission completed. Once out of harm's way, you switch to NAV mode and return to your home airbase.

AIR-TO-AIR (AA) MODE

Air-to-Air (AA) mode is used to detect and attack aircraft only. The HUD shows information pertinent to missile and gun combat. An instrument light in the front seat control panel reads **AA** when your aircraft is set in Air-to-Air mode. Another indication that the aircraft is in AA mode is the presence of an Allowable Steering Error (ASE) circle in the center of the HUD if a missile is "in priority."

ALLOWABLE STEERING ERROR (ASE)

The Allowable Steering Error cue is the large circle surrounding the Waterline Mark when a missile has been placed "in priority." It represents the missile's engagement envelope. The AIM-120 AMRAAM has a dashed line ASE circle. All other missiles have a solid line ASE circle. If no ASE circle is displayed on the HUD, you are either out of missiles or have placed your guns in priority.

STEERING DOT

The Steering Dot is a visual cue which indicates the direction you must fly in order to fire a missile at a "locked" target. When a target is "locked" on radar, a Steering Dot and Target Designator box appear on the HUD. You receive a "shoot cue" only after the Steering dot is brought within the ASE circle. This signifies that you have attained a proper engagement envelope for that missile.

TARGET DESIGNATOR BOX (TD)

The Target Designator Box is a small square box which appears around an enemy aircraft after it has been "locked" by your radar. It is simply an aid in helping you to locate your target during combat. TD box symbol never leaves the HUD itself. If your target moves off the HUD, a Target Locator line is generated instead. The Target Locator Line extends from the center of the ASE to the target.

AIR-TO-GROUND (AG) MODE

Air-to-Ground (AG) mode is used for detecting and attacking ground targets only. Various ground targeting and bombing cues appear on the HUD. You are unable to detect aerial targets when in AG mode and vice versa. Instrument lights in both the front and back seat read **AG** when the aircraft is set to Air-to-Ground Master mode.

The symbology appearing on the HUD depends greatly on the type of delivery mode you have selected. The symbology associated with each type of delivery mode is covered separately within the Air-to-Ground sections.

NAVIGATION (NAV) MODE

Navigation mode (NAV) is used for normal flight in non-hostile environments such as flying between friendly bases, training missions, etc. It displays none of the important combat related information found in the other two modes and is best used only when taking off and landing. Instrument lights in both the front and back seat read **NAV** when the radar is placed in Navigation Master mode.

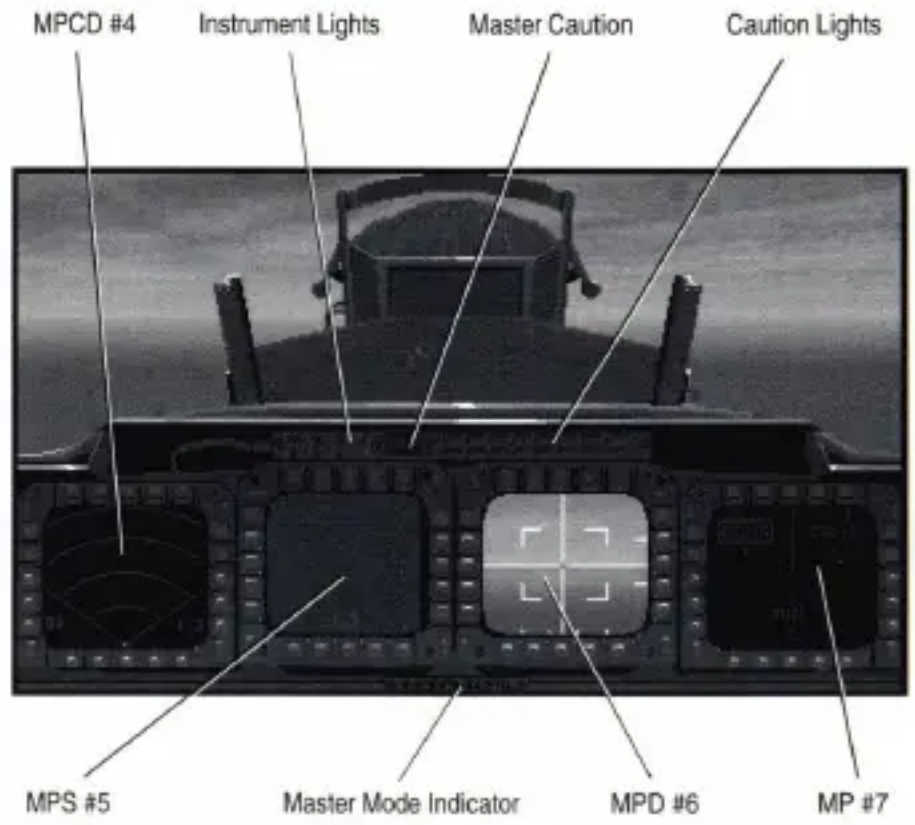
NAV mode is particularly important when landing. In addition to the normal symbology, the Instrument Landing System (ILS) automatically activates once your Landing Gear is extended near a friendly airbase. The ILS consists of a Bank Steering Bar and Glide Slope Indicator which aid you in lining up on the runway and establishing a safe rate of descent. These two indicators appear centered within the HUD pitch ladder. (See the sections on Landing and ILS for more detailed information).

MULTI-PURPOSE DISPLAYS (MPD/MPCDS)

The F-15E cockpit is equipped with seven *Multi-Purpose Displays* (MPDs). Three of these have color displays and are referred to as *Multi-purpose Color Displays* (MPCDs). There are two MPDs and one MPCD available to the pilot in the front seat. The Weapon System Officer has two MPDs and two MPCDs to monitor from the back seat. These displays represent the heart of the F-15's effectiveness by providing the crew with a means of monitoring combat conditions from a distance.

Each of the MPD/MPCDs can be programmed to view a variety of display screens. You may call up different displays on any monitor of your

REAR COCKPIT FOUR ACROSS WITH MPD/MPCDS



choosing. Only experience will teach you how best to arrange the modes to suit your own tastes. Initially the displays default to the optimal settings for each of the Master Modes.

Most display screens are available regardless of the Master Mode you have selected. Some, however, are only available in certain Master Modes. This is particularly true with the radar display screens. For example, the Air-to-Ground radar display screen is not available when you are in Air-to-Air Master mode.

COMMANDING A MPD/MPCD

To call-up a particular display screen on a MPD/MPCD, simply press the *MPD Control* (shft Key plus display number). You may toggle between the various display screens by repeatedly pressing these keys.

In order to operate the *Zoom View In/Out* feature of a display screen, the MPD/MPCD must first be put "In Command." Press *In Command* (alt Key plus display number). Four vertical bars appear at the bottom of the display to signify that it is now "In Command."

It is not necessary that a MPD/MPCD be "In Command" before toggling between display screens. Being "In Command" only affects the ability to *Zoom View In/Out*. Note that not all displays *Zoom View In/Out* regardless of whether they are "In Command."

MPD/MPCD Display numbers

Pilot MPD/MPCDs		Weapon Officer MPD/MPCDs	
Front Left MPD	(1 Key)	***Rear Outer Left MPCD***	(4 Key)
Front Right MPD	(2 Key)	***Rear Inner Left MPD***	(5 Key)
Front Center MPCD	(3 Key)	***Rear Inner Right MPD***	(6 Key)
		Rear Outer Right MPCD	(7 Key)

MPD/MPCD SCREENS

AN/APG-70 RADAR DISPLAYS

The radar display provides you with different screens according to the Master Mode selected. When the radar is not emitting radiation (not active), it is in SNIFF mode. When switching between Master Modes, the radar display automatically changes its default setting for each of the modes.

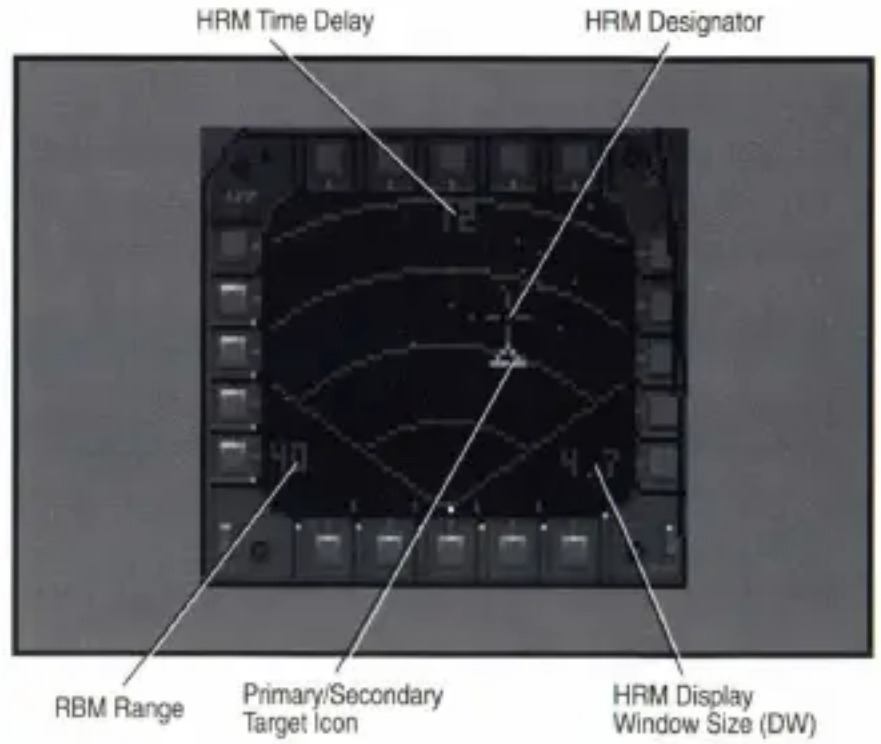
In the Navigation and Air-to-Air Master Mode, the radar appears on the MPD/MPCD as a 4 x 4 grid with an artificial horizon line in the center. If a missile weapon is placed in priority, the display will contain an ASE circle as well. When set in *Standard Mode*, these display modes are marked **STD.**

In Air-to-Ground Master Mode, the radar defaults to the **Real Beam Map (RBM)** display.

REAL BEAM MAP (RBM)

The aircraft's radar system sweeps a 120 degree arc along the ground ahead of the aircraft. The radar returns reflected off the ground are then used to produce the Real Beam Map (RBM). The RBM is used to produce real-time photo-quality High Resolution Maps (HRMs) to pinpoint ground targets.

REAL BEAM MAP DISPLAY



When your aircraft is set in AG Master Mode, the RBM is displayed on the radar screen. In the lower left hand corner is located the RBM's current range setting. The RBM range can be set to either 10, 20, 40, and 80 nautical miles. In the lower right hand corner of the RBM is located the current HRM map scale (in nautical miles).

Moving your *Controller* over the RBM display changes the cursor to a cross-hair. An HRM of the appropriate scale is created by pressing *Selector #1* when the cross-hair is positioned over the desired area (usually a target dot).

HIGH RESOLUTION MAP DISPLAY (HRM)

High Resolution Maps (HRMs) are produced in flight by using the RBM to select a desired mapping location. Once produced, the HRM may be used to designate targets right from the display screen. HRMs come in seven separate scales, ranging from 40 nautical miles down to .67 nautical miles. The lower the scale map produced, the higher the level of detail.

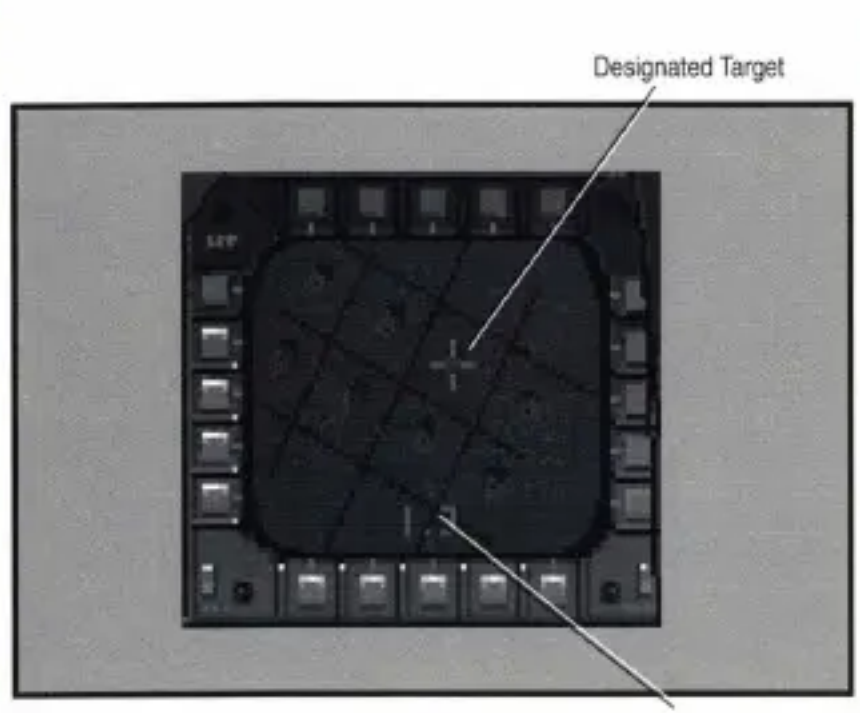
TACTICAL SITUATION DISPLAY (TSD)

The TSD is a colorized map which may be called up on any available MPD/MPCD. Your aircraft is shown as a white icon and remains centered in the display as you move.

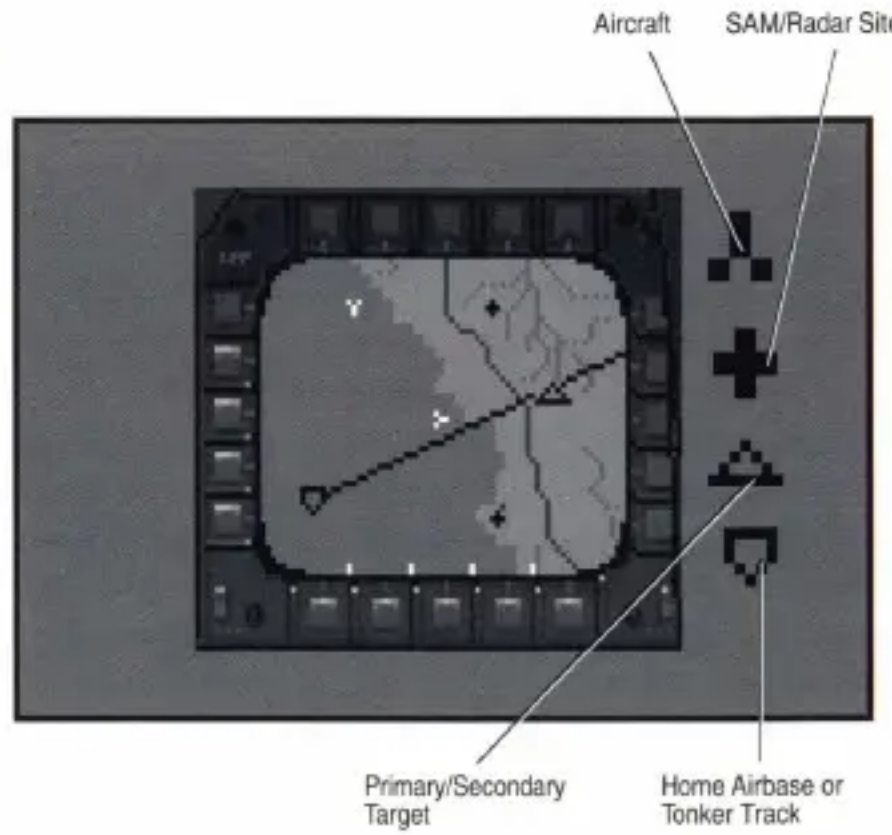
In *Standard Mode* (only), enemy forces appear on the TSD. Enemy aircraft are shown as black icons and missiles (both friendly and enemy) are shown as moving yellow squares.

Radar sites (SAM and GCI) are shown as simple crosses. Their color varies according to whether they have detected your aircraft. If the cross

HIGH RESOLUTION MAP DISPLAY



STANDARD MODE TSD



is green, the radar is unaware of your presence. If colored brown, the radar is currently tracking you. If colored red, the radar has your aircraft "locked." Radar sites send out a pulse which is shown as a green circle on the display.

Various ground features (cities, roads, rivers, lakes, etc.) also appear on the TSD in their appropriate colors, i.e water is blue. *Zoom View In* (z Key) and *Zoom View Out* (x Key) are especially helpful when viewing terrain and enemy troop locations.

HORIZONTAL SITUATION INDICATOR (HSI)

The HSI is a 360 degree rotational compass which displays your aircraft's current heading. The vertical line at the top of the display is known as the "Lubber Line." This line corresponds to your aircraft's heading. As the compass ring rotates, your aircraft remains centered on the display even though it is changing its heading. When the automatic pilot is engaged, A/P appears on the display just below the aircraft icon.

The display is oriented so that the direction of flight is always toward the top of the display. The top of the display is always located in the aircraft's 12 o' clock (in front of the aircraft) position regardless of heading.

HORIZONTAL SITUATION INDICATOR (HSI)

INSTRUMENT LANDING SYSTEM SYMBOLOGY

When using the HSI in NAV mode with landing gear down, the Instrument Landing System (ILS) is engaged. A Heading Marker is located on the outer perimeter of the HSI compass. The location of this symbol on the compass indicates the direction of the nearest airbase.

When the ILS is operating an arrow appears in the center of the compass. This arrow is known as the Course Pointer and it indicates the runway alignment in relation to your aircraft's approach.

The mid-section of the arrow is known as the Course Deviation Indicator (CDI). The CDI represents the centerline of the runway. If you are lined up properly with the runway, the CDI remains aligned with the Course Pointer. If, however, you begin to deviate off course, the CDI moves. An aircraft which is off to the left of the runway causes the CDI to move to the right of the Course Pointer. An aircraft which is off to the right of the runway causes the CDI to move to the left.

The four dots represent a width of 5° with 1 1/4° between them. They represent the cone width of the airbase's localizer beam which your aircraft uses to operate its ILS.

ATTITUDE DIRECTOR INDICATOR (ADI)

The ADI displays an electronic artificial horizon which indicates the aircraft's pitch and banking condition. It is particularly useful during night missions when a pilot is unable to see the ground and may become spatially disoriented.

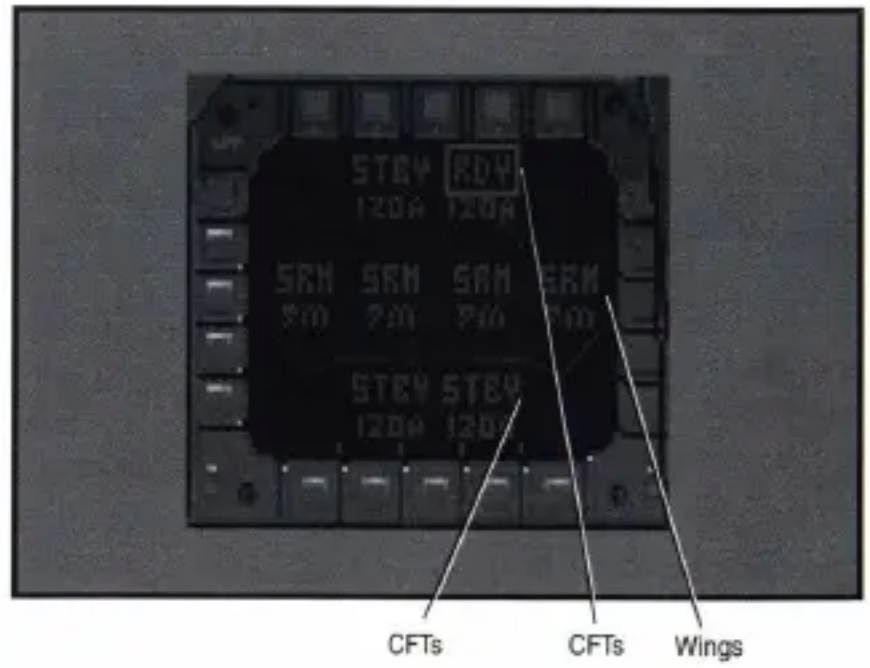
The circular display is divided into two colored sections; blue for above the horizon and gold for below. The line formed by joining these sections together is the artificial horizon. In the center of the ADI is a Waterline Mark similar to the one located on the HUD. Superimposed over the display is a pitch ladder which is numbered in 10 degree increments.

Along the top of the ADI is a Heading Indicator which corresponds to the one located on the HUD. The upper right box gives the altitude in feet and the upper left box shows your current airspeed in knots.

The ADI also displays the Instrument Landing System (ILS) Bank Steering Bar and Glide Slope Indicator. (See the section on Landing for further details concerning the ILS).

ATTITUDE DIRECTOR INDICATOR (ADI)

AIR TO AIR ARMAMENT



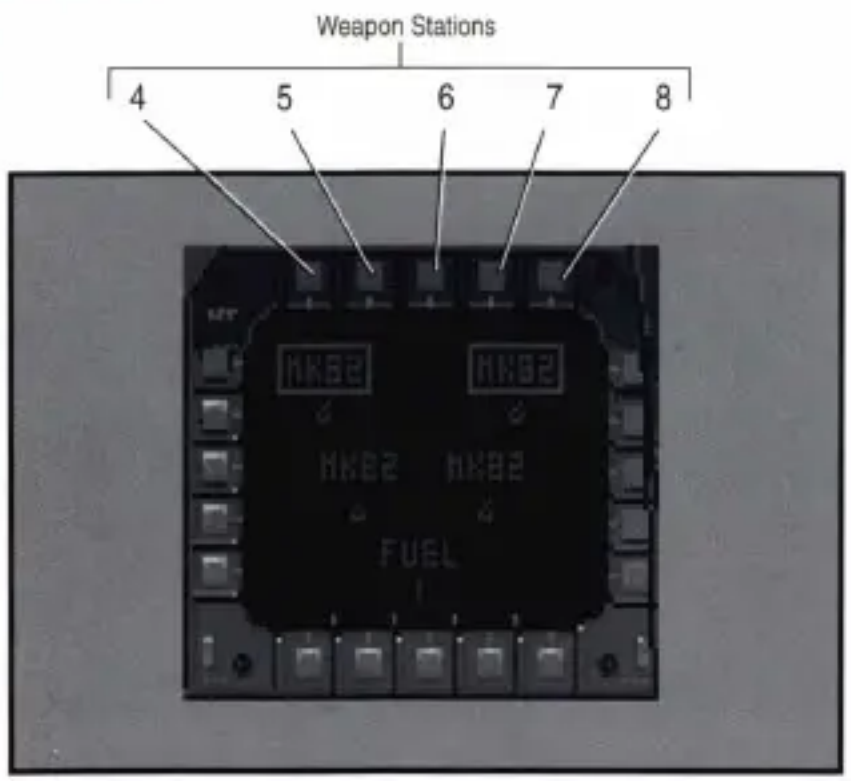
ARMAMENT (ARMT)

The Armament display is a graphic representation of your ordnance load. There are two different displays according to your current Master Mode.

In Air-to-Air Master Mode, the display shows your missile layout. The location of each of the missiles on the weapon stations is signified by their numeric designation. Above each designation, the type of missile is listed as either MRM (Medium Range Missile) or SRM (Short Range Missile). Depending on which missile is placed in priority you get either a RDY (ready) or STBY (stand-by).

In Air-to-Ground Mode, the display shows your bomb layout by type and number. As bombs are dropped, the amount of remaining ordnance is displayed. Fuel tanks appear as FUEL on the centerline station.

AIR TO GROUND ARMAMENT



HUD REPEATER

HUD REPEATER

The HUD repeater gives the Weapons System Officer the ability to "see" what is going on in the pilot's HUD. Certain visual cues appearing on the HUD are duplicated. This simplified HUD can be called up on an MPD/ MPCD in the rear seat. It is superimposed on the NAV FLIR display.

MASTER CAUTION (MC)

The Master Caution display gives you a full text listing of all areas currently damaged and inoperable. (See the *Authentic Mode* Damage section for more details concerning aircraft systems).

MASTER CAUTION (MC)

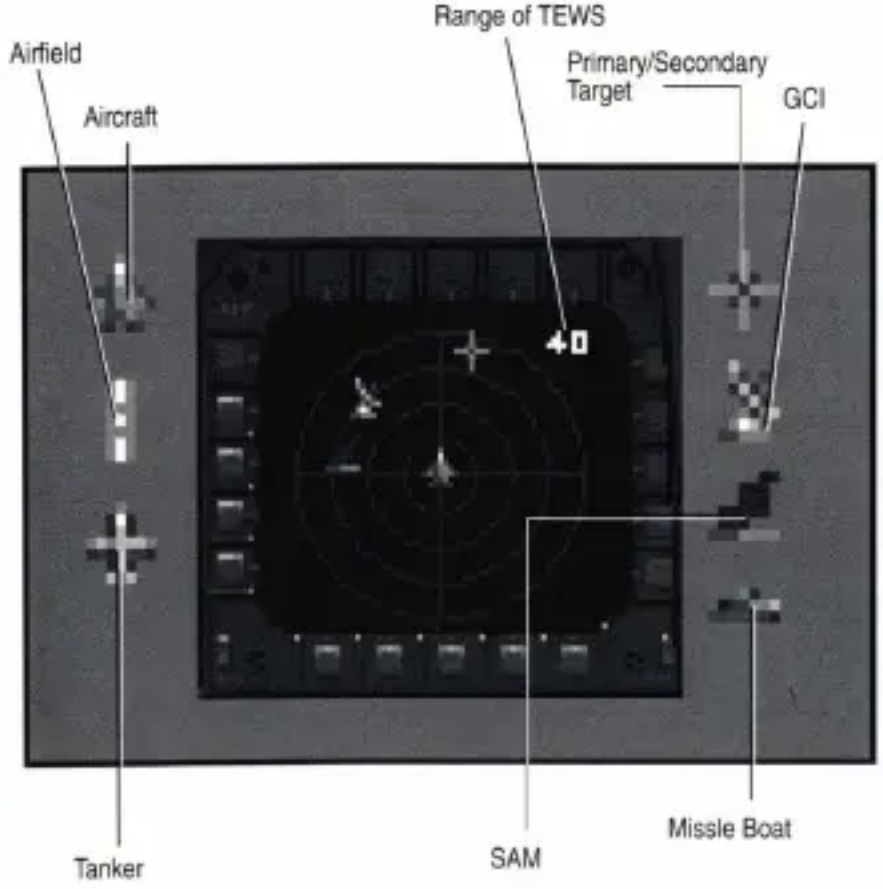
TACTICAL ELECTRONIC WARFARE SYSTEM (TEWS)

Each F-15 is equipped with its own Tactical Electronic Warfare System (TEWS), pronounced "Tooz." The TEWS suite is an integral part of your aircraft's self-defense capability and consists of an array of sensors and antenna receivers.

Regardless of Master Mode, the TEWS display screen is initially defaulted to the front seat right MPD (Display #2). Thereafter, you may place this display screen on any of the MPD/MPCDs you desire.

Although the TEWS is just another MPD/MPCD view, it is important enough to warrant discussion in a separate section. There are full descriptions of the TEWS display under both the Standard and Authentic Mode sections of this manual. Refer to the appropriate section for further details.

STANDARD MODE TEWS



AUDIO WARNING AND SITUATION MESSAGES

ON-BOARD COMPUTER (BITCHIN-BETTY) MESSAGES

Because Pilots and Weapon Systems Officers have their attention focused outside the cockpit much of the time, visual signals and cues often go unnoticed. In an effort to remedy this problem, audio warnings and messages are automatically sent by the on-board computers directly into the crew members' headsets. These calls are triggered by the appropriate simulation event and are not controlled by the player(s). A female voice is used because studies have shown that it immediately gains the attention of male pilots.

"caution TF failed": repeated twice whenever the LANTIRN navigation pod is damaged.

"warning, engine fire left": repeated twice whenever the left engine is damaged.

"warning, engine fire right": repeated twice whenever the right engine is damaged.

"caution": repeated twice whenever any other system is damaged.

"bingo fuel": repeated twice when bingo fuel point is reached.

"warning, low fuel": repeated twice when only 5,000 pounds of fuel are remaining.

GENERAL INFORMATION MESSAGES

In addition to warnings generated by the on-board computers, outside sources contribute to the crew's overall Situational Awareness. Information may be generated from a number of support elements. These elements include AWACS, J-STARS, KC-10s and even the airbase control tower.

The crew members themselves provide a great deal of information. An F-15E Pilot and WSO must function as a team in order for them to be successful in combat. The cockpit messages they pass back and forth are the product of years of flying together and being able to anticipate each others' next move.

The following general information messages are triggered by simulation events and are not controlled by the player(s). Each message is an audio repetition of the text messages normally displayed on the screen. They are received by the player as situational updates along with a tag indicating the origin of the message.

"spike": a ground-based radar site has tracked your F-15E.

"spike mud": a ground-based radar site has locked up your F-15E.

"mud launch": a ground-based radar or IR missile has been launched at your F-15E.

"launch, launch": an airborne radar or IR missile has been launched at your F-15E.

"primary achieved": the primary target has been destroyed.

"secondary achieved": the secondary target has been destroyed.

"cleared for take off": sent to player at the start of a mission when flying from a ground base.

"cleared, good hunting": sent to player at the start of a mission when flying from a tanker track.

"good landing": sent to player when making a good ground landing.

"fence in": sent to player when entering enemy controlled airspace.

"fence out": sent to player when leaving enemy controlled airspace.

"Welcome Back": received from KC-10.

AWACS (AIRBORNE WARNING AND COMMAND SYSTEM)

In addition to the radar and TEWS there is another method of detecting enemy aircraft. Pilots are free to call on orbiting AWACS aircraft by pressing ***Picture*** **(shft p Key).** When contacted, the AWACS aircraft gives you a quick report of aircraft in your vicinity.

Since the AWACS must handle many aircraft requests simultaneously, several minutes may elapse before your next call for information goes through. If the AWACS aircraft is busy with other aircraft, you receive a "Status Unchanged" message. Allow some additional time to pass before attempting to contact AWACS again.

AWACS messages deal only with enemy aircraft. AWACS is not equipped to detect status of enemy ground forces, that is not its job. The AWACS aircraft responds by giving you one of five different messages which are coded for brevity. They consist of a one word Situation Report (SITREP) followed by a directional indication and range. Directional indications are given as bearings from **your** aircraft, not the AWACS.

CLEAR: no enemy aircraft detected along the indicated bearing out to the indicated range.

BOGEYS: unidentified aircraft detected at the given bearing and range.

SNAP: enemy aircraft detected at the given bearing and range. You are directed to engage these aircraft.

CHICKS: friendly aircraft detected at the given bearing and range.

HOMEPLATE: an advisory which gives the bearing and approximate range to your home airfield or tanker track.

Note that all aircraft detected more than 40 nautical miles from your aircraft will be listed as bogeys, identification unknown. Those aircraft detected less than 40 nm from your aircraft are identified by the prefix "Snap" or "Chicks" accordingly.

JOINT SURVEILLANCE AND TARGET ATTACK RADAR SYSTEM (J-STARS)

Boeing E-8C J-STARS (Joint Surveillance and Target Attack Radar System) aircraft are used to detect ground movement in the battle area and are responsible for processing real-time intelligence. If conditions change in your target areas after you have taken off, you can expect a call from the J-STARS. You may be redirected to strike different targets as a result of the fluid nature of modern war.

If contacted by J-STARS (code-named Blackjack), you receive a message in the form "blackjack target N4732 (example of latitude) W1243 (example of longitude)." The new target coordinates are fed directly into your Upfront Controller along with the target type. New targets override your original orders concerning your Primary and Secondary targets.

VI. SIMULATION VIEW AND CONTROL KEYS

A good airplane can never compensate for a poor pilot. Before you can master an opponent, you must first master the aircraft. In other words, flying a supersonic aircraft is difficult enough without having to worry about being detected and shot down. Due to the immediacy of modern air combat, it is worth the time spent familiarizing yourself with the cockpit and controls before you take to the air.

Because of the complexity of *F-15 Strike Eagle III*, there are well over a hundred separate command keys, each performing a different function. A complete list of these keys can be found on the **Key Reference Card**. Keep the card handy for immediate use during flight.

This section is a detailed summary of all the various command functions which you will use during the normal course of play. Each function is referred to by its name as it appears on the Key Reference Chart in italics followed by the actual keystroke in parenthesizes. The keys have been grouped into appropriate sections for quick reference. These include pilot and external views, flight controls, radar, general simulation controls, etc.

SIMULATION VIEWS KEYS

***Normal Cockpit View* (F1 Key)**: This view is the normal forward view perspective of both the Pilot and WSO. The HUD is positioned directly in front of the pilot's field of vision. The WSO forward cockpit view includes the four MPD/MPCDs. This is the most commonly used view during the simulation.

***Full Frontal View* (F2 Key)**: This view gives you an unobstructed look out the front of the aircraft from both seats. The HUD does not appear when using this view.

***Rear View* (F3 Key)**: From the pilot seat, this view gives you an over the shoulder look out the rear of the aircraft. Your Weapon Systems Officer is visible in the foreground. From the back seat, the WSO has a fantastic field of vision over the tail of the aircraft.

***Pilot View* (F4 Key)**: This view is from the pilot's perspective and provides a field of vision wherever the pilot is physically able to swivel his head. It is moveable using key pad directional number keys; 2- down, 4- left, 8- up, and 6- right. Pressing the 5 Key (in the middle of the Keypad) automatically centers this view to its default position.

***Remote View* (F5 Key)**: This is a external view which defaults initially to the rear of the aircraft. It is moveable using key pad directional number keys; 2-down, 4-left, 8-up, and 6-right. You may also use the *Zoom View In/Out* commands as well. Pressing the 5 Key (in the center of the Keypad) automatically centers this view to its default position.

***Side View* (F6 Key)**: This is an external view used to view the aircraft's profile. It is useful in judging pitch angle, checking the landing gear status, etc. You may use *Zoom View In/Out* commands in conjunction with this view.

***Missile View* (F7 Key)**: In this view, you are positioned directly behind your own missile (or bomb) as it flies to its target. If more than one weapon is in flight, you are positioned behind the one most recently launched. If no ordnance is in flight, you are positioned behind your aircraft. Multiple presses of this key cycles you through all in-flight ordnance including enemy ordnance launched at your aircraft. You may use *Zoom View In/Out* commands in conjunction with this view.

***Padlock View* (F8 Key)**: The Padlock view is similar to the Pilot View (F4 Key) with one exception. This view automatically "locks" your view on a specific air target. In a tight turning, twisting dogfight this view allows you to maintain visual contact with an enemy aircraft. Multiple key presses allows you to cycle through eligible aircraft.

***Tactical View* (F9 Key)**: Your view perspective is looking past your aircraft at an enemy air or ground target. This view automatically rotates to keep both your aircraft and target in view. It is invaluable when dogfighting by letting you "see" your maneuvers in relation to the enemy's.

The view is also helpful when lining up for a second or third pass over a ground target. You may use *Zoom View In/Out* commands in conjunction with this view. In Air-to-Air Mode, multiple presses of this key cycles through eligible aircraft.

***Reverse Tactical View* (F10 Key):** This view is the same as the Tactical View (F9 Key) except that you are seeing the situation from the enemy's perspective. It automatically pans to keep your plane in view. Experienced pilots find this a very dramatic view when making attack runs on ground targets. You may use *Zoom View In/Out* commands in conjunction with this view. In Air-to-Air Mode, multiple presses of this key cycles through eligible aircraft.

***Zoom View In* (z Key)**: This view moves your view perspective inward (closer) to the object or area. You may *Zoom View In* the focus of certain MPD/MPCD screens as well as some external fields of vision.

***Zoom View Out* (x Key)**: This view moves your view perspective outward (farther away) from the object or area. You may *Zoom View Out* the focus of certain MPD/MPCD screens as well as some external fields of vision.

***Front/ Back Seat Toggle* (' Key)**: This key toggles between front and back seat forward views. Your view perspective is transferred accordingly.

***Front Seat Look Up/Down Toggle* (/ Key):** This key allows the pilot to look down at the front cockpit "dash." From this view the pilot can see MPCD #3 and the Engine Management Display. This view is not available from the Rear seat.

***Back Seat Look Left* (< Key)**: This view may be accessed only from the back seat. It allows you to see the left side of the cockpit which is partially obscured when using a front view of the back seat displays.

***Back Seat Look Right* (> Key)**: This view may be accessed only from the back seat. It allows you to see the right side of the cockpit which is partially obscured when using a forward cockpit view of the back seat displays.

***Key Pad Directional Keys* (Numeric Keys):** These keypad numerical keys are used to rotate external views of the aircraft as follows; (2- down, 4- left, 8- up, and 6- right). The keypad keys only function if the keypad *num lock* key is depressed. If using a keyboard only, the *num lock* function must be toggled on and off accordingly. Pressing the 5 Key (in the center of the Keypad) automatically centers this view to its default position.

Players must make the distinction between the numerical keys which run in linear fashion across the top of their keyboard and key pad number keys. Key pad number keys are those numbers arranged in a square with the 5 key in the center.

When a mouse is available, full screen external views reshaped to a smaller size. Use the mouse to move the cursor to the lower right corner of the view screen, press left mouse button and click-drag the view to the desired size. Once reduced in size, the higher frame rate results in smoother action.

PRIMARY FLIGHT CONTROL KEYS

***Accelerate* (= Key)**: Pressing this key increases the throttle of your aircraft in 10% increments. Your power status can be viewed on the Engine Management display as it is increased.

***Max Accelerate* (shft= Key)**: Pressing this key immediately increases your throttle to 100% (Full Military Power).

***Afterburner* (a Key):** Your fighter is equipped with an afterburner that allows you to gain additional power at the expense of a great deal of fuel. To kick in the afterburner, press *Afterburner* (a Key). To turn off the afterburner, simply press *Deceleration* (- Key) once.

***Decelerate* (- Key)**: Pressing this key decreases the throttle of your aircraft in 10% increments. Your power status can be viewed on the Engine Management display as it is decreased.

***Cut Throttle* (shft- Key)**: Pressing this key immediately shuts down the engines to 0% power.

***Automatic Pilot* (p Key):** By pressing this key, the Automatic Pilot takes immediate control of the aircraft. Automatic Pilot acts differently depending on the flight mode. In the *Standard Mode* flight model, the Automatic Pilot directs the aircraft toward your active INS Sequence Point.

In the *Authentic Mode* flight model, Automatic Pilot maintains your current heading without regard for Sequence Points. While under Automatic Pilot, the aircraft remains in level flight at a constant speed and current altitude. The [**A**] Cockpit light illuminates while the Automatic Pilot is engaged. In *Standard Mode*, Automatic Pilot is instantly disengaged if you change your course or altitude. In *Authentic Mode*, minor course and altitude corrections do not disengage the Automatic Pilot.

***Landing Gear* (g Key):** This key toggles your landing gear up and down. When your landing gear is up, your Mach number and current g-force stress is displayed in the lower left hand corner of the HUD. The [**G**] Cockpit light illuminates when your gear is down. In *Standard Mode* at Difficulty Level 1, the landing gear raises automatically after takeoff once you have climbed above 100 feet. In *Authentic Mode*, the landing gear cannot be extended if you travelling faster than 300 knots.

***Brake* (b Key):** If your aircraft is on the ground, toggling this key turns your wheelbrakes On/Off while you taxi. If your aircraft is airborne, this key toggles between the speedbrake's two positions, retracted (in) and extended (out). You can use the *Side View* (F6 Key) to watch as the speedbrake extends and retracts. The [**B**] Cockpit light illuminates when either the wheelbrakes or speedbrakes are in use.

***Directional Controls* (Arrow Keys)**: The keyboard directional control keys act as the *Controller* when the simulation is not being played with a joystick. By pressing the directional keys, you are able to maneuver the aircraft just as if you were using a joystick.

***Eject* (shft e Key):** When your aircraft is so damaged by enemy fire that it is no longer airworthy, it's probably time to bail out. Press *Eject* (shft e Key) to bail out but remember, there are no second chances. If you "punch Elvis" (hit the Eject key) by mistake, you are not given an opportunity to take it back. Don't wait until the last minute before "hitting the silk." You cannot safely eject if your aircraft is inverted or travelling over 400 knots.

SECONDARY FLIGHT CONTROL KEYS

***Next Sequence Point* + (s Key)**: This key toggles forward through your current INS Sequence Point settings. It is designed to be used in conjunction with the Automatic Pilot function in the *Standard Mode* flight model. Once you reach your active Sequence Point, it is switched to the next Sequence Point for you.

***Next Sequence Point*- (alt s Key)**: This key toggles back through your current INS Sequence Point settings. It is designed to be used in conjunction with the Automatic Pilot function in the *Standard Mode* flight model.

***Running Lights* (shft l Key)**: This key toggles your running lights (including Formation lights) On and Off. Lights are important for close formation flying at night. Otherwise, turn them off or they assist the enemy in spotting your aircraft. The [**L**] cockpit light illuminates when your Running lights are on.

***Pause* (alt p Key)**: The *Pause* instantly freezes the simulation. You may resume play by pressing any key.

***Accelerate Time* (shft t Key)**: There are eight levels of accelerated time. Accelerated time is useful when flying long distances without encountering any significant threats or opposition. The current acceleration multiplier is displayed in the upper left corner of your HUD.

***Normal Time* (t Key):** *Normal Time* returns the simulation to its normal non-accelerated time rate.

***Picture* (shft p Key)**: By pressing this key, you are able to get an accurate assessment of enemy air activity along your current heading. The AWACS gives you the location of friendly and unidentified aircraft as well.

MENU CONTROLS/OPTIONS KEYS

***Escape* (esc Key)**: Pressing *Escape* (esc Key) during flight gives you a number of game options displayed on a Menu bar across the top of the screen. Pressing *Escape* (esc Key) while in a Home screen subsidiary exits you to the previous screen.

***Joystick Recalibration* (alt j Key)**: Press this key if your joystick is causing the aircraft to fly erratically. After pressing this key, stir your joystick briefly to facilitate the recalibration.

***Quit* (alt q Key)**: Pressing *Quit* immediately ends the simulation and returns you to DOS. It does not save information to disk so your current mission score is lost.

ELECTRONIC COUNTER-MEASURE CONTROL KEYS

***Jammer Active* (j Key):** Although the Jammer works automatically to counter enemy radars, it must first be activated by pressing the *Jammer Active* (j Key) toggle. The [**J**] Cockpit light illuminates when the Jammer is active. Note that the Jammer only functions, even though active, when a radar threat exists.

***Release Chaff* (c Key)**: Pressing this key releases a bundle of radar-distorting chaff. You are initially given 18 bundles. A message appears on the HUD indicating that you have released the defense and how many you have remaining.

***Deploy Flare* (f Key)**: Pressing this key releases a flare designed to decoy incoming heat-seeking missiles. You are initially given 12 flares. A message appears on the HUD indicating that you have released the defense and how many you have remaining.

AIRCRAFT MASTER MODE CONTROL KEYS

***Master Mode Selector* (m Key)**: By pressing this key, you can toggle between the aircraft's three Master Modes: [**NAV**], [**AA**], and [**AG**]. The Master Modes effect the symbology displayed on the HUD accordingly. Cockpit instrument lights indicate your current Master Mode status.

AIR-TO-AIR MODE (AA)

***Guns* (1 Key):** Pressing this key puts your 20mm Vulcan M61A1 gun into priority. A floating gunsight pipper appears on your HUD and the radar is placed in Auto-acquisition mode.

***Short Range Missile* (2 Key)**: Pressing this key puts a heat-seeking AIM-9 in priority. A solid-line ASE circle appears on your HUD to signify that you have selected a short range missile.

***Medium Range Missile* (3 Key)**: Pressing this key puts a medium range AIM-120A or AIM-7M in priority.

***Pickle Button* (spacebar Key or Joystick Button #2)**: Each time this key is pressed a single missile is fired. The type of missile fired depends upon which missile selection is "in priority."

***Fire Guns* (ENTER Key)**: Each time this key is pressed, one burst of 20mm rounds is fired.

***Identification; Friend or Foe, IFF* (i Key)**: IFF is a method utilized to determine if an unidentified contact is a friend or enemy aircraft. Special electronic systems are used to "interrogate" a target to determine its nature. Press *IFF* (i Key) to interrogate a locked target (IFF is only effective with a locked target).

If friendly, a transponder in the "locked" aircraft automatically responds by "squawking" back with an audible tone. In addition, the [I] instrument light illuminates in the cockpit. If the aircraft is hostile, you do not get a "squawk." Instead, the target icon immediately changes into an "X" symbol on the radar display.

AIR-TO-GROUND MODE (AG)

Weapon systems may be selected and put into priority by pressing the key corresponding to their position on the aircraft. The weapons are positioned on one or more of the following external stations:

Left Wing Station	**(4 Key)**	***Right Conformal Station***	**(7 Key)**
Left Conformal Station	**(5 Key)**	***Right Wing Station***	**(8 Key)**
Centerline Station	**(6 Key)**		

***Pickle Button* (spacebar Key)**: Each time this key is pressed, ordnance is deployed. The number of air-to-ground weapons actually released depends upon type of ordnance loaded on the weapon stations in priority.

***Jettison Ordnance* (shft j Key):** By pressing this key, all air-to-ground ordnance is immediately jettisoned (released). This makes the aircraft more nimble in air combat but may make it impossible to complete your mission. You cannot jettison air-to-air ordnance in this manner but you can always fire it off as you would normally.

***Bombing Mode* (shft b Key):** By toggling this key, you are able to change your method of weapon delivery from AUTO mode to CDIP and vice versa.

HUD CONTROL KEYS

***Declutter HUD* (d Key)**: This key removes the Pitch Lines from your HUD for better pilot visibility if necessary. Additionally, this key annotates your Heading, Altitude and Airspeed along the bottom edge of any external view.

***Increase HUD Brightness* (h Key)**: This key gradually increases the brightness of your HUD display each time it is pressed.

***Decrease HUD Brightness* (shft h Key)**: This key gradually decreases the brightness of your HUD display each time it is pressed.

***LANTIRN HUD FLIR* (shft f Key)**: This key toggles the HUD FLIR ON and OFF. By pressing this key once, you superimpose the FLIR view used for night vision on the HUD. Press the key a second time and the HUD view returns to normal. This view is extremely useful for night operations because it allows the pilot to "see" in total darkness.

RADAR CONTROL KEYS

***Radar Activate* (r Key)**: This key toggles your AN/APG-70 radar between ON and SNIFF mode. SNIFF mode puts the radar on standby and does not emit detectable radiation. This makes it more difficult for the enemy to detect you. Accordingly, the EMIS light does not illuminate while the radar is in SNIFF mode.

***Long/ Short Range Scan Toggle* (INSERT Key)**: In *Authentic Mode*, this key toggles the radar between Long and Short Range Scan. A detailed explanation of these two scan modes may be found in the *Authentic Mode* section dealing with operating the radar.

***TWS* (DELETE Key)**: By pressing this key, your radar is placed in *Track While Scan* mode. A detailed explanation of TWS (pronounced "Twiz") may be found in the *Authentic Mode* section dealing with operating the radar.

***Radar Range Selection* (HOME Key)**: By pressing this key you toggle the range of the radar scope. The range of the scope, calibrated in nautical miles, appears in the upper right corner of the MPD screen.

***Designate Target* (backspace Key)**: This key is used to designate targets for both your air-to-air and air-to-ground weapons. By repeatedly pressing this key you are able to cycle through all eligible air or ground targets that appear on your radar display. This key is also used in conjunction with the HUD Pipper Designator when neither the radar, RBM, or HRM screens are "in command.

***Lock Target* (l Key)**: By pressing this key, you specifically target an enemy aircraft with your radar. Any weapons fired are directed at the target you currently have "locked-up" target.

***Break Lock* (k Key)**: This key immediately breaks any radar "lock" you currently have on a target. The radar automatically reverts to the last active mode you selected. (Not used in *Standard Mode*)

***Auto-Acquisition/Boresight Toggle* (END Key)**: Auto-Acquisition "locks-up" the first or closest target detected out to a maximum range of 10 nm. Boresight is used to "lock-up" a target using the HUD pipper. (Not used in *Standard Mode*)

***Antenna-Up 5 Degrees* (PAGEUP Key)**: Raises the elevation of your radar search arc by 5 degrees. (Not used in *Standard Mode*)

***Antenna-Down 5 Degrees* (PAGEDOWN Key)**: Lowers the elevation of your radar search arc by 5 degrees. (Not used in *Standard Mode*)

TRAINING MODE KEYS

Training Mode **(alt t Key)**: By pressing the Training Mode key, you can safely ignore all enemy aircraft and missiles. In addition, you have an automatic radar altimeter that adjusts your altitude to keep you above 300 feet. However, it only makes mild corrections, and is useless if you make wild maneuvers. If Training mode is activated at any time, you receive no score for the current mission.

Resupply **(alt r Key)**: In Training mode missions (only) you can get an infinite supply of fuel and ammunition. Each time you tap *Resupply*, your fuel tank is filled and your ammunition is increased to the maximum possible level. This option is especially useful in target practice and on sight-seeing trips. Resupply also automatically repairs all damage suffered previously by your aircraft.

Day/Night Forward Acceleration **(alt= Key)**: Each time this key is pressed, time advances by five minutes.

Day/Night Backward **Acceleration (alt- Key)**: Each time this key is pressed, time advances by five minutes.

Slew Controls Slew controls are used to rapidly move your aircraft across the theater world (Tactical Situation Display). The amount moved by each press of the key is determined by Zoom perspective of the TSD.

Slew North **(alt s Key)**, ***Slew West*** **(alt z Key)**,

Slew East **(alt c Key)**, ***Slew South*** **(alt x Key)**,

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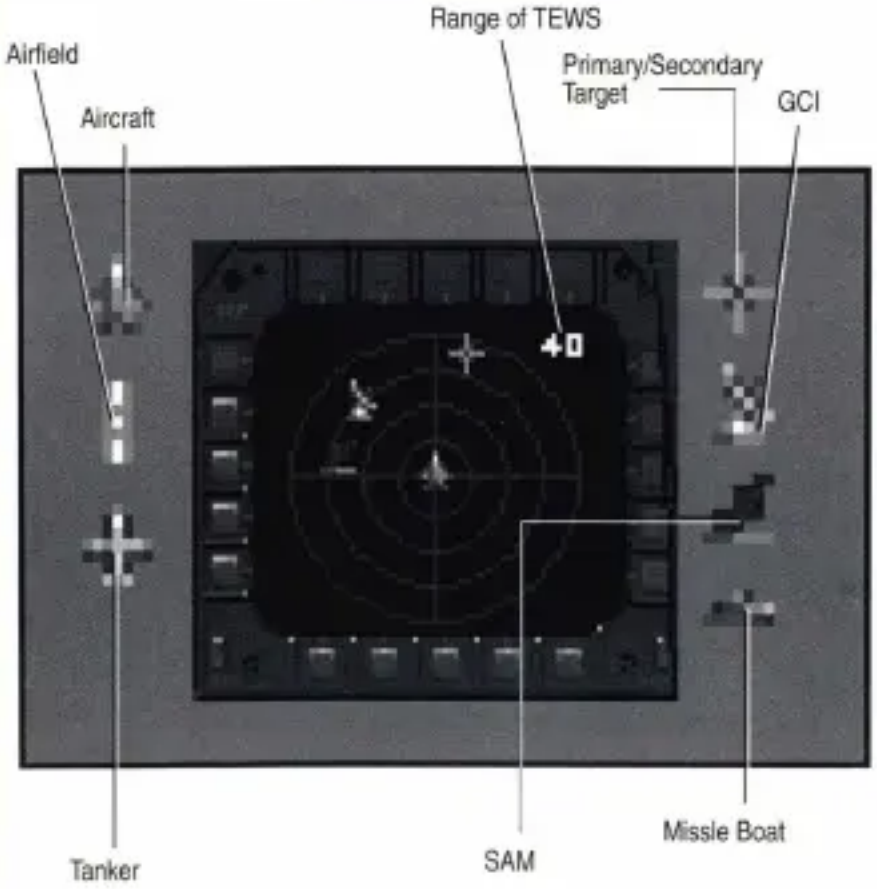
VII. STANDARD MODE

Standard Mode is actually a collection of option settings rather than a distinct simulation unto itself. At the beginning of each mission, you are given an opportunity to set the Difficulty Level and Reality options on the Home screen.

When you initially set the Difficulty Level, Reality options default to either *Standard* or *Authentic* Mode. The lower you set the overall Difficulty level, the more options are defaulted to *Standard Mode*. You are free, however, to change these settings without affecting the level of Difficulty you have previously chosen.

STANDARD MODE (TEWS)



The following section is devoted to describing how to operate the aircraft when all the Reality options are set to *Standard Mode*. It includes a Check Ride which takes you through an entire mission from takeoff to landing.

STANDARD MODE TACTICAL ELECTRONIC WARFARE SYSTEM (TEWS)

You have two principal means of detecting enemy aircraft and avoiding being surprised yourself; radar and the **Tactical Electronic Warfare System (TEWS)**. Of the two methods, TEWS is perhaps more useful because it is an undetectable passive system which does not alert the enemy to your presence.

In *Standard Mode*, the TEWS is an extremely powerful tool. It gives you a 360 degree "God's eye" view of the tactical situation surrounding your aircraft. At a glance you are able to immediately see the enemy's air and ground deployment.

The TEWS display appears on an MPD/MPCD as four concentric circles centered on a pair of horizontal and vertical lines. Your aircraft, a grey aircraft icon, remains centered on this display. It is oriented so that the top of the display always represents the aircraft's 12 o'clock position (in front of you). The bottom of the display is your aircraft's 6 o'clock position (behind you).

The range of your TEWS is variable. You may select ranges of either 10, 20, 40, or 80 nautical miles. Your range selection is shown in the upper right corner of the display. To change the range setting, the MPD/MPCD must first be placed "in command." Press the **alt Key** plus the MPD/MPCD number to put the display in command. You may now press ***Zoom View In* (z Key)** or ***Zoom View Out* (x Key)** to toggle between range settings.

Regardless of the range setting, the distance between each of the circles is equal to one quarter of the total range setting you have selected. For example, if your TEWS is set to 40 nm, the circles are located at 10, 20, 30, and 40 nautical miles. At 20 nautical miles, the circles represent radii of 5, 10, 15, and 20 nm.

DISPLAY ICONS

The TEWS display shows the location of all enemy aircraft and ground-based defenses. SAM installations appear as green missile icons, GCIs appear as red radar dish icons. Missile Boats appear on the TEWS as grey colored ship icons. Enemy aircraft appear in three different colors depending upon their altitude. They are colored yellow if above you, orange if at the same altitude and dark red if the enemy is below you. Once you "lock-up" enemy aircraft, a Forget Designator box appears around the icon.

All missiles, both friendly and enemy, appear as small fast moving lines. Friendly missiles are colored white, enemy radar-guided missiles are red and heat-seeking missiles are yellow. Your ECM (flares and chaff) appear on the display as long as they remain effective.

The *Standard Mode* TEWS gives you a complete picture of the enemy disposition. Use this display to plan your route to the target around heavy concentrations of SAM sites and avoid being jumped by enemy fighters.

STANDARD MODE AIR-TO-AIR COMBAT

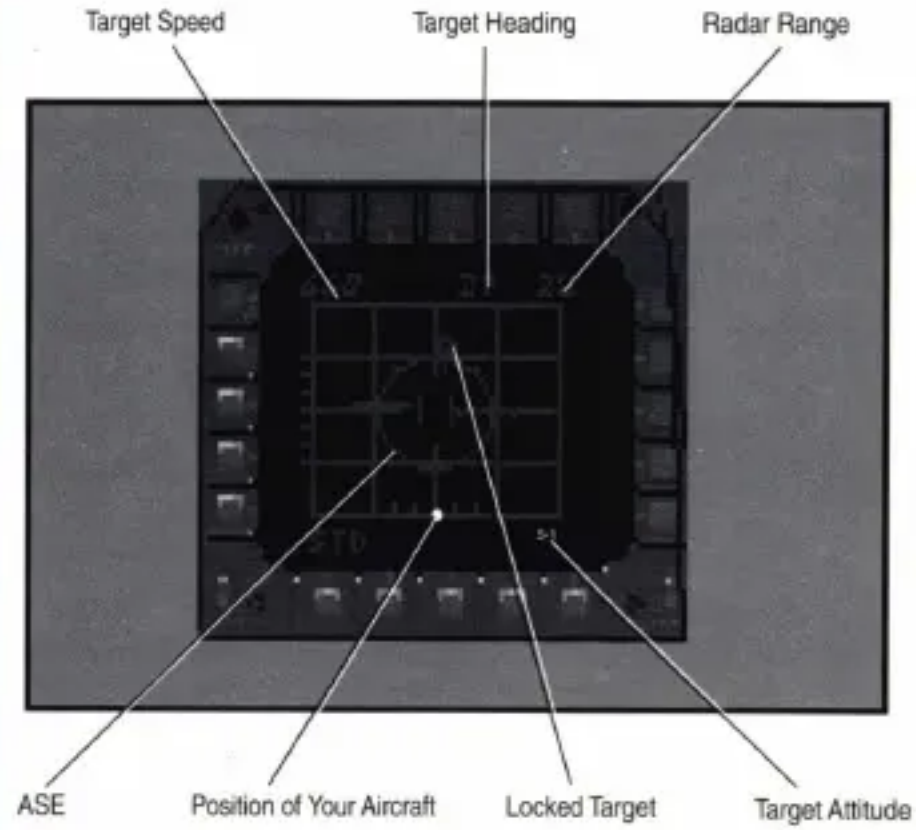
Before you can shoot down an enemy aircraft, you must first detect it on radar. Fortunately, the F-15E's AN/APG-70 radar is up to the task. The radar display defaults to the left hand MPD in the front seat of the aircraft. Place your aircraft in the proper mode for detecting enemy aircraft by toggling the ***Master Mode*** **(m Key)**. Cycle through the Master Modes until **AA** (Air-to-Air Mode) reads on the instrument panel at the bottom of the screen.

THE STANDARD MODE (STD) RADAR DISPLAY

In *Standard Mode*, the radar display is marked **STD** on the display screen and begins the mission already activated. Your F-15E is positioned at the **bottom** of the radar display looking up or ahead. The display itself is divided into a 4 x 4 square grid in 30° increments along the x-axis. The y-axis is divided into four increments measured in nautical miles (nm) and may vary in size. This gives the radar a 120 degree search arc originating at the nose of the aircraft. Since your aircraft is centered along the bottom edge of the display, only aircraft ahead of your point of view are detected and appear on the grid.

The *Standard Mode* (STD) radar screen displays all detected aircraft by superimposing them on the grid. Aircraft appear on your radar as small

STANDARD MODE RADAR (STD)



solid squares and are considered already designated targets. The most threatening target is always the first to be "locked" (You must "lock" additional targets individually before firing. If more than one aircraft appears, you may cycle through them using ***Designate Target*** **(back-space Key)** or ***Lock Target*** **(l Key)**. The target you are currently designating appears as an open square. All others appear as small solid squares.

All icons have a small line which points in the direction of flight. This "**Lead Line**" shows the target's heading and should be thought of as an extension of the aircraft's nose, not its tail.

Across the top of radar display, starting from the upper left corner, are a number of numerical values. The first value is the designated target's current speed, followed by its heading, and finally, the range setting of the display.

Across the bottom of the radar display in the lower left corner is located the abbreviation **STD**, for *Standard Mode*. In the lower right corner is the target's current altitude in thousands and hundreds of feet. The first value is the thousands and the second value is the hundreds. A "shoot cue" appears to the left of the altitude numbers when you are able to fire on a designated target.

RADAR STATE

Technically, the radar system is never turned off during a flight. When not operational, the radar is placed into an inactive or standby mode called **SNIFF** mode. While in SNIFF mode the radar antenna continues to scan along its designated path, but does not emit any energy. When the radar system is in SNIFF mode, the EMIS indicator is not illuminated.

RADAR RANGE

The radar range can be changed by toggling the ***Radar Range*** **(Home Key)**. The range can be set to 10, 20, 40 or 80 nm. The individual horizontal breaks still represent one quarter of the maximum range setting. For example, with a 20 nm setting, the individual horizontal breaks indicate ranges from 0 (your aircraft's position at the bottom) to 5, 10, 15, and 20 nm from your F-15E.

BOGIES & BANDITS

When detected, all aircraft appear as bright green boxes on the radar. Do not let the relative position of the green boxes disorient you. Just keep in mind that they are out in front of your F-15E. They may be above or below your current altitude, but at this point you have determined the most important piece of information; that a potential threat exists.

DESIGNATING A TARGET

Any target appearing on radar is automatically designated. If multiple targets appear only the closest target is initially "locked." You must lock these targets individually. Use either ***Designate Target*** **(backspace Key)** or ***Lock-up Target*** **(I Key)** to cycle through the eligible targets. When a target is "locked" that aircraft is now referred to as the **Primary Designated Target (PDT).**

The purpose of designating a target is to paint it with radar energy in order to track and fire at it. Air-to-air missiles require that the firing aircraft's radar focus at a specific target. When a target is designated (locked), it changes from a solid square to an open box on the STD display. The information on the HUD then changes from general radar data to specific target data.

RADAR AUTO-RANGING

The radar incorporates automatic range scaling. If the PDT's range is approximately 2 nm less than the most distant range boundary, the selected range automatically switches to the appropriate increment. For example, if the radar display is set at 40 nm, as the PDT's range falls to 18 nm, the radar automatically switches into 20 nm range.

HUD SYMBOLOGY

RADAR RANGE SCALE

When a target is designated (locked) and a missile selected, the HUD is filled with information pertaining specifically to that target (PDT). Running vertically along the right side of the HUD is a line called the Radar Range Scale. It appears only when a target is designated (locked).

The Radar Range Scale contains two small horizontal lines and a caret. The caret corresponds to the target's range. The two small lines are maximum and minimum missile ranges. The upper line is the selected missile's maximum range; or RMAX. The lower line is the selected missile's minimum range; or RMIN. The target's range caret must obviously be situated somewhere between RMAX and RMIN for a valid shot.

In addition to the horizontal tick marks and range caret, the Radar Range scale displays the Closure Rate between yourself and the designated enemy aircraft. To the immediate left of the range caret is the rate of closure (in knots). A positive value indicates the speed at which you are overtaking the target; a negative value is the speed at which the target is pulling away from you.

In addition to the missile range data, two other important cues appear on the HUD; the Allowable Steering Error circle (called ASE) and the Steering Dot.

The ASE is the large circle located in the middle of the radar display. It represents the engagement envelope of the particular missile you have selected. A dashed line ASE circle appears if you have placed medium range AIM-120A AMRAAM missiles "in priority." It appears as a solid line circle if either an AIM-7M Sparrow or AIM-9M Sidewinder are "in priority."

The Steering Dot is initially located somewhere within the ASE or along the Target Locater Line leading to the Target Designator Box (TD). It is a moving cue which indicates the direction you must fly in order to engage your designated target.

TARGET DESIGNATOR BOX (TD)

The Target Designator Box is another very useful reference cue. Designated aircraft appear on the HUD with a TD "box" around them as a visual indication of their location. The TD box never totally leaves the HUD even if the target exits the HUD's field of view. In this instance, the TD box is parked at the edge of the HUD.

A line appears from the center of the ASE to the target's location when it leaves the HUD's field of vision. This line is appropriately called the **Target Locator Line**. If you follow the line, the target is at the other end.

To fire a missile, maneuver your aircraft in such a way that the Steering Dot (a single small dot on the HUD) is brought within the confines of the ASE circle. Once this is done, the target is considered within the missile's engagement envelope.

Now is probably is a good time to temporarily halt the simulation for a moment by pressing *Pause* (alt p Key). Refer to the HUD illustrations in this chapter concerning the radar system to identify what this new information all means. When you are ready to continue, press any key to resume the simulation.

AIR-TO-AIR COMBAT (MISSILE)

It has all come down to this moment. You have a PDT and have placed the correct missile "in priority." The PDT is within the weapon's **Rmax** and **Rmin** as shown on the vertical Range Scale. Finally, the Steering dot is within your ASE circle. All you need now is to see a "Shoot Cue" appear underneath the HUD TD box signifying that you are clear to fire.

SHOOT CUE

Once the target is brought within range and missile constraints, a Shoot Cue appears on the lower center of the radar display. It also flashes directly below the TD on the HUD.

Shoot Cues appear as a triangles for the AIM-9M and AIM-7M and six-pointed stars for AIM-120A. If the Shoot Cue disappears before the shot is taken, you must wait for it to reappear. The shot is good only as long as the Shoot Cue is visible.

After you receive the "Shoot Cue," you may fire the missile by pressing ***Pickle Button* (spacebar Key)**. One missile of the appropriate type is then launched. Chances are that you can spot the missile heading for the target. For a nice effect, press ***Missile View* (F7 Key)** to view the action from the missile's perspective or ***Reverse Tactical View* (F10 Key)** to view it from the enemy's vantage point.

LOCK-SHOOT LIGHTS

The cockpit is also equipped with Lock-Shoot lights located on the canopy braces. These lights illuminate when a target is "locked." When you receive a "shoot cue," the Lock-Shoot lights flash.

AIM-9M & AIM-120A (FIRE AND FORGET MISSILES)

The AIM-9A Sidewinder and the AIM-120A AMRAAM are both "fire and forget" missiles. Once launched, you need not retain a radar lock-on in order for the missile to intercept the target. In fact, you may immediately fire a missile then switch to a new target. You may also turn completely away from the target if the tactical situation dictates a retreat.

AIM-7M (MAINTAINING RADAR LOCK)

The AIM-7M Sparrow is a semi-active radar homing missile (SARH). It homes in on the reflected radar energy generated by your F-15E. After launch, it is necessary that you maintain a radar lock-on (called "painting the target") until the missile intercepts the target. It is not necessary to maintain a Shoot Cue, however. This means keeping the target in your radar's beam envelope until the missile hits. In a tight-turning, close-in fight, this may prove to be impossible.

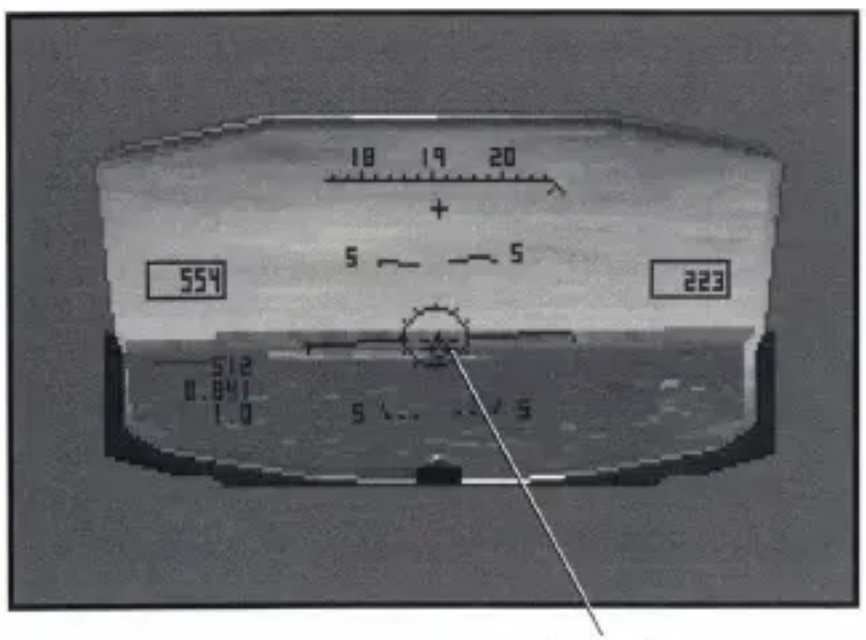
TIME TO INTERCEPT (TTI)

Once an AIM-7M or AIM-120A missile is launched, the TTI data is displayed on the HUD as the final target entry in the lower right corner. The value is expressed in seconds to intercept the target. If the missile loses its lock, "LOSING" displays in place of the seconds. TTI is extremely useful as the target must be continually illuminated by your radar for an AIM-7M Sparrow to intercept a target.

BREAK X

If a target range passes **below RMIN**, a large "X" appears in the center of the HUD and the center of the radar display. This symbol, called a "Break X," indicates that the range is too short and a shot is no longer possible. You must reposition your F-15E for a clear shot. If you take the shot, it will miss. Sometimes you may find that switching from a medium range to a short range missile brings the target back within constraints.

GUN HUD



Gun Reticle

AIR-TO-AIR COMBAT (GUN)

The gun design of the F-15 series of aircraft overcame a limitation that long plagued the the F-4 Phantom II and earlier aircraft. With the gun mounted directly along the aircraft's horizontal axis, you must actually fire more at a target's nose than at its midpoint. This is due to the natural fall of the shells as gravity takes over.

It tight-turning furballs (dogfights) you had to fire at a target just out of your point of view. To compensate for this early design deficiency, the F-15's gun is canted up 2º from the true horizontal plane. Some ingenious designer figured out that that was just enough cant to overcome this force at 3,000 feet or less.

Your F-15E is equipped with a **Lead Computing Optical Sight** called LCOS (pronounced "L-COS") adapted for use with its M61A1 20mm gun. The LCOS uses your F-15E's motion and the radar range to estimate the target velocity and acceleration.

The M61A1 gun has a maximum effective range of approximately 3,000 feet, or roughly one half of a nautical mile. The gun and gunsight are boresighted to engage targets at 2,250 feet. This is the optimum target engagement range although the gun can fire a great deal further. Anything beyond 3,000 feet decreases the effectiveness of the gun due to shell dispersal.

When the gun is placed "in priority," the ASE is removed and replaced by a gunsight reticle. When lacking a locked target, the reticle is positioned just above center line in the HUD due to the gun's 2º cant. With a locked target, the reticle floats in the HUD, compensating for your F-15E's flight parameters.

With only 512 rounds of 20mm on board, you can't afford to waste many shots. Even so, do not hesitate to shoot. To attack a target using your gun, simply place the reticle on the target. Once in range, pull the trigger. Could it get any easier?

The reticle must be stabilized on the target before a shot can be taken. The art of of stabilizing the reticle on the target is a matter of maintaining a g-level that is already attained. Quick, sharp violent maneuvers just throw the reticle around the HUD. Make small course corrections ahead of the target and let the enemy aircraft fly into your gunsight.

IDENTIFICATION, FRIEND OR FOE (IFF)

Modern air combat seldom affords pilots the opportunity to visually identify a potential target. IFF is a method utilized to determine if an unidentified contact is a friend or enemy aircraft. Special electronic systems are used to "interrogate" a target to determine its nature.

Press ***IFF*** **(i Key)** to interrogate a locked target (IFF is only effective with a locked target). If friendly, a transponder in the locked aircraft automatically responds by "squawking" back with an audible tone. The [I] instrument light illuminates in the cockpit.

If you do not get a "squawk" the target icon immediately changes into an "X" symbol on the radar display indicating that the aircraft is hostile. Do not wait to see the whites of his eyes. Shoot first and ask questions later.

STANDARD MODE AIR-TO-GROUND COMBAT

Now that you have eliminated potential air threats to your mission, it's now time to discuss attacking ground targets. The F-15E is known as the "Strike Eagle" because of its role as a ground attack fighter. In fact, your missions are exclusively strike missions versus ground targets. Air combat is usually a secondary and incidental consideration. While air combat is more glamorous, strike missions are where F-15E pilots earn their pay.

PRIMARY AND SECONDARY TARGETS

Each mission requires you to attack a Primary and Secondary target. These two targets are generally related in that the same type of ordnance is used to destroy both. The order in which you attack these targets is unimportant and left up to you. Just remember, if you attack the Secondary target first, keep enough bombs on board to destroy your Primary.

Your prescribed flight path is displayed on the Tactical Situation Display (TSD). The first Sequence Point along the path is always the Primary Target. The second Sequence Point is the Secondary target.

AIR-TO-GROUND BASIC CONCEPTS

The AN/APG-70 radar system is able to distinguish ground targets with great accuracy. In addition, the synthetic aperture radar (SAR) has the ability to create highly detailed maps of potential target areas. Supporting the radar system is the LANTIRN AN/AAQ-14 Targeting Pod with its high resolution FLIR and laser designator.

The primary Air-to-Ground (AG) radar displays are the **Real Beam Map (RBM)** and the **High Resolution Map (HRM)**. These two displays work in tandem to create near photo-quality views of potential target areas. They may also be used to designate targets directly from their display screens. This effective combination gives the F-15E an all-weather strike capability which is second to none.

AIR-TO-GROUND RADAR

REAL BEAM MAP (RBM)

The Real Beam Map display is the default function of the aircraft's radar when set to Air-to-Ground Mode. The radar always points in the direction your aircraft is travelling so that the RBM is heading stabilized. It has a fixed azimuth of 120° and a maximum range of 80 nm.

The value in the lower left corner is the current range setting. Your F-15E is positioned at the **bottom** of the radar display looking up or ahead. Terrain and ground objects appear as small dots on the grid ahead of your point of view.

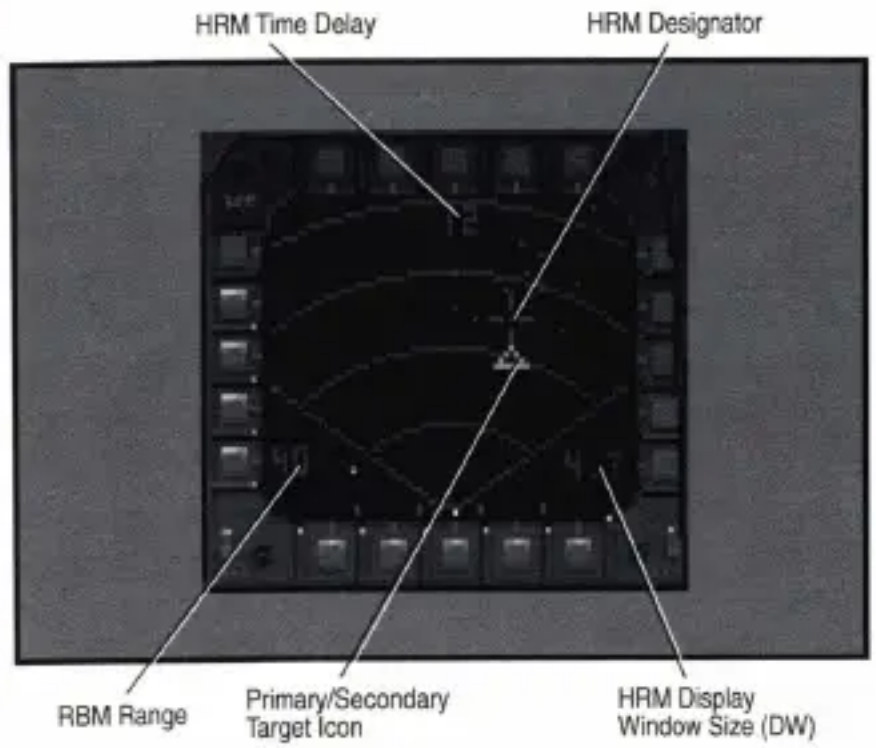
RBM (RADAR RANGE)

The display is divided into four incremental arcs each representing one-quarter of the total display range in nautical miles (nm). The range can be set to 10, 20, 40 or 80 nm. Therefore, if the range is set to 80 nm, the individual arcs indicate ranges from 0 (your aircraft's position at the bottom), to 20, 40, 60, and 80 nautical miles.

At shorter ranges, the individual arcs still represent a quarter of the maximum range setting. For example, with a 20 nm setting, the individual arcs indicate ranges from 0 (your aircraft's position at the bottom), to 5, 10, 15, and 20 nm from your F-15E. The radar range can be changed by pressing ***Radar Range*** **(Home Key)** to toggle between the various range settings.

The value in the lower right corner of the RBM display is the current **Display Window Size (called DW)** for the HRM. If the display is place "in

REAL BEAM MAP DISPLAY



command," the DW can be scaled downward in increments by pressing ***Zoom View In*** **(z Key)**. It can likewise be scaled upward by pressing ***Zoom View Out*** **(x Key)**.

RBM (TERRAIN & TARGETS)

Terrain is displayed as shades of dark to light, with black as no terrain, or water, to brighter shades for higher elevations. Non-terrain objects appear as bright pips against the background terrain. Depending on the range selected, these objects can appear as close concentrations or dispersed groupings. Objects on an 80 nm range RBM appear much closer together than the same objects on a 20 nm range RBM.

RBM (SEQUENCE POINTS)

Sequence Point reference cues are placed on the RBM to assist in identifying important points on a mission. Your home airbase, Refueling Tanker, Primary and Secondary Targets are all indicated on the RBM at the appropriate locations. Primary and Secondary Targets are indicated as triangles. Your home airfield or KC-10 Refueling Tanker is marked with a five-sided symbol resembling home plate in baseball.

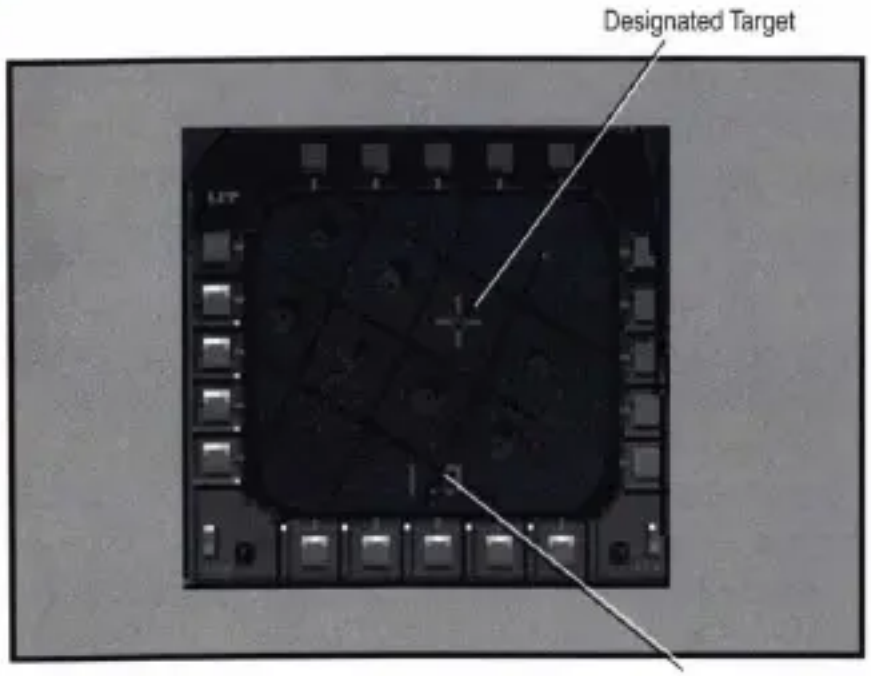
RBM (DESIGNATING TARGETS)

The manner in which ground targets are designated is highly dependent upon the weapon being employed. Targets can be designated for area effect weapons such as Rockeye IIs directly from the RBM. Other means are used to designate targets for point effect weapons such as AGM-65 Mavericks.

Ground targets can be designated by pressing ***Designate Target*** **(backspace Key)**. The closest eligible ground target is then designated. You can cycle through all eligible ground targets by repeatedly pressing the ***Designate Target*** **(backspace Key)**. Targets are designated beginning with the closest and working back to the furthest away.

Using the keyboard to designate targets (or make HRMs) in this manner is a cumbersome process. A mouse device makes this task much faster and easier. If you have a mouse device, you can freely move the cursor to designate any target directly on the RBM display screen. The cursor changes to a cross-hair pointer on the RBM. To designate a target (or make an HRM), simply move the pointer over the target and press the **right mouse button**.

HIGH-RESOLUTION MAP DISPLAY



HIGH RESOLUTION MAP (HRM)

A High Resolution Map (HRM) is created by the AN/APG-70's synthetic aperture radar capability. HRMs depict all the significant terrain features and manmade objects captured within the beam. The radar Doppler shifts are then converted into near-photographic images which can be used to provide guidance for air-to-ground ordnance.

HRMs may be produced in seven different scaled increments 40, 20, 10, 4.7, 3.3, 1.3 and 0.67 nm. At the largest setting, 40 nm, a large, low detail map is produced. The maps continue to get more detailed as the size of the map being generated is scaled down. The greatest amount of resolution is produced at the .67 nautical mile scale.

PRODUCING AN HRM

HRMs are produced using targets or areas designated on the RBM display screen. When you have designated a desired target or area on the RBM, press ***Lock-target* (l key)** to produce an HRM.

Again, using the keyboard to cycle through all the eligible ground targets is a tedious process. It is far better to utilize a mouse device to move the cursor and call-up an HRM from the RBM screen. When using a mouse device, the cursor changes to a cross-hair as it is moved across the RBM.

To produce an HRM using a mouse, simply place the cross-hairs over the area or target desired and press *Selector #1*. Pressing *Selector #1* causes an HRM of the area or target designated on the RBM to be produced. It is displayed on the same MPD/MPCD as the RBM *unless* another monitor has been toggled to display HRMs.

The same HRM can be reproduced in higher detail by pressing the ***Zoom View In* (z Key)** to scale down the DW. Press the **left mouse button** again (at the new scaled down DW parameter) to produce the higher detailed image.

HRM (SEQUENCE POINTS)

Sequence Point reference cues are placed on the HRM to assist in identifying important points on a mission in the same manner as was described for the RBM.

HRM (DESIGNATING TARGETS)

Targets can be designated for all weapons directly from the HRM. Use the *Controller* to move the cursor or press ***Designate Target* (backspace Key)** to designate a ground target on the HRM. You can cycle through all eligible ground targets by repeatedly pressing ***Designate Target* (backspace Key)**.

This is a cumbersome process. Again, the preferred method if you have a mouse, is to freely move the cursor to designate any target on the HRM map. Pressing the **right mouse button** designates the target.

OPTICAL GROUND TARGET DESIGNATION

The majority of the ground targeting systems are optical in nature. However, they are so closely tied to the AN/APG-70's ground mapping systems that they are included here as part of the Air-to-Ground radar modes.

In addition to the RBM and HRM, there are three other methods of ground target designation which are optical in nature. These methods are **LANTIRN Targeting FLIR, the HUD Target Designator** and **HUD Pipper**.

The LANTIRN FLIR is an all-weather, night/day system optical targeting device. The HUD TD and HUD Pipper are optical, daylight only systems. They are point of view systems that utilize the old mark 1.0 eyeball to designate targets.

Any one of these three additional methods can be utilized to designate a ground target. A target designated with one method can be changed or redesignated by using another method.

AN/AAQ-14 LANTIRN TARGETING POD

The LANTIRN Targeting Pod, along with the AN/AAQ-113 LANTIRN Navigation Pod, makes the F-15E an awesome Strike-fighter at night. Nestled under the left engine nacelle, the Targeting Pod combines a Forward Looking Infrared (FLIR: rhymes with gear) targeting sensor with a laser ranger/designator into a single compact package.

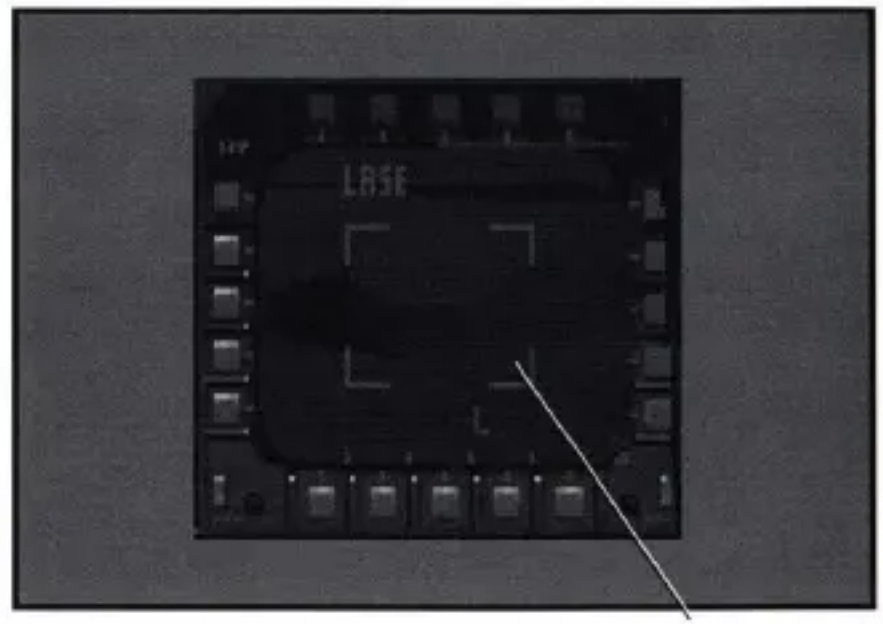
The targeting FLIR works in conjunction with the RBM/HRM systems. It can be utilized independently for complete passive targeting acquisition. Once targets are detected by the radar or the FLIR, the laser designator is then utilized to "paint" them for subsequent delivery of guided weapons.

LANTIRN TARGETING POD IMPLEMENTATION

Since the LANTIRN Targeting Pod utilizes passive systems, it is always active and on-line for immediate use whenever Air-to-Ground Master Mode is selected. While the AN/APG-70 Radar System is detectable, use of the Targeting Pod does not effect the F-15E's EMIS status.

The Targeting Pod FLIR has a maximum range of 10 nautical miles. The closer targets are to the FLIR, the easier they are to recognize and identify. Even so, the FLIR provides a high degree of picture contrast. This

LANTIRN TARGETING POD,
FORWARD LOOKING INFRARED (FLIR)



Zoom-In Image

enables details to be identified even at the maximum range. In *Standard Mode*, the FLIR display screen is colorized.

If the RBM/HRM systems are active, the targeting pod's viewpoint is automatically slaved to the RBM/HRM's point of view. In any case, the Targeting Pod's FLIR has a 360° field of view. Targets designated via the RBM/HRM display systems are also automatically designated by the FLIR and centered in its point of view.

HUD TARGET DESIGNATOR

When the radar is in Air-to-Ground mode, the cursor changes to a diamond shaped target designator if moved over the HUD. Note that the target designator is only active **if a mouse is available**. To designate a target, position the diamond over any point on the ground as viewed through the

HUD and press either mouse button. The HUD target designator may not be used to mark air targets; it designates ground targets only.

HUD PIPPER DESIGNATION METHOD

The Pipper method of ground target designation is like the Air-to-Air Bore Sight radar mode of designating aerial targets. The pipper is located at the point of the F-15E's velocity vector. Pressing the ***Designate Target* (backspace key)** designates the ground target currently under the pipper. A slightly nose-down attitude is very useful when utilizing this method. Again, it may not be used to mark air targets. This method designates ground targets only.

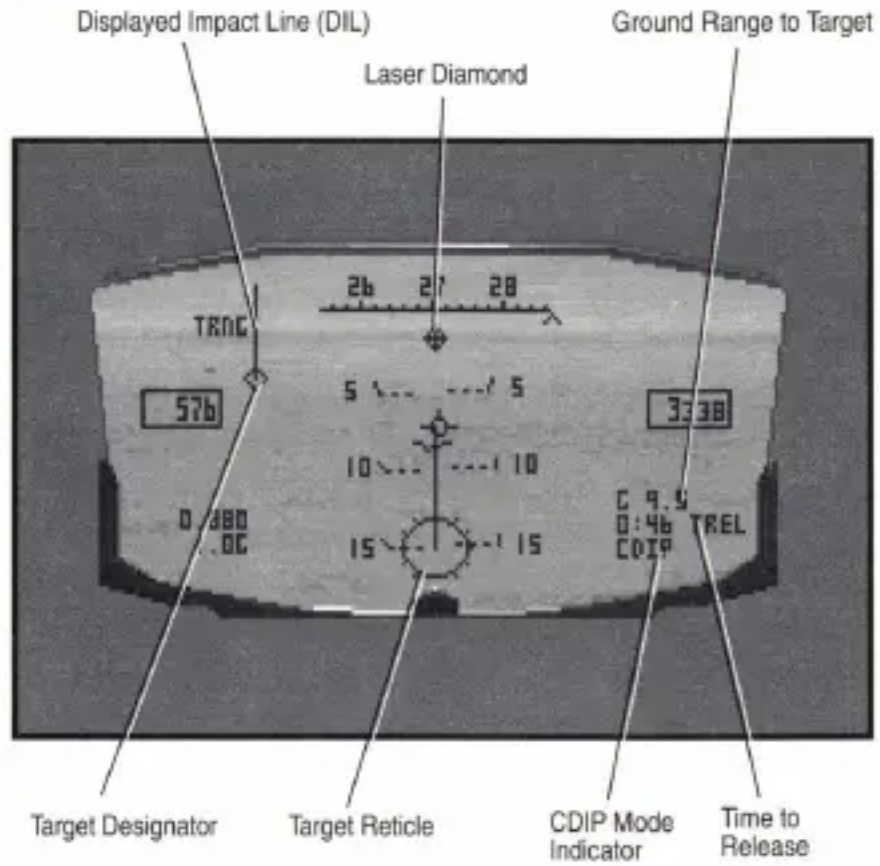
AIR-TO-GROUND DELIVERY MODES

All these air-to-ground designation methods lead to one specific end, the destruction of a target. There are three delivery modes for air-to-ground ordnance: CDIP, AUTO, and Guided Delivery. Laser delivery mode is actually a subset of AUTO and CDIP.

Some weapons utilize only one mode of delivery whereas other weapons can utilize different modes of delivery depending upon pilot preference or conditions. Where options exist, the delivery mode is selected by pressing ***Bomb Mode* (shft b key)**. The active delivery mode is displayed in the lower right corner of the HUD.

All modes, except CDIP, require a valid designated target before any weapon can be dropped or launched. You must get through that portion of the process before you can even think about sending any ground ordnance on its way.

CONTINUOUSLY-DISPLAYED IMPACT POINT (CDIP)
Bombing Mode



CDIP MODE

CDIP (Continuously Displayed Impact Point: pronounced "See-dip") is a computer-assisted, manually initiated release mode for the delivery of all types of free-fall bombs including: Mk. 82, Mk. 84, BSU-49, BSU-50, Rockeye II, CBU-87, CBU-89, BLU-107/B Durandal, and GBU-10 and GBU-12 laser glide bombs.

CDIP constantly computes the impact point of the priority weapon. A weapon is placed "in priority" by pressing the desired ***Weapon Station* (4-8 key)**. CDIP automatically computes the impact point based on the selected weapon. When the weapon is released, you can be fairly assured of its impact point. It is the easiest mode to understand and master.

CDIP MODE TARGETING FLIR SYMBOLOGY

If a target is designated, it is marked by cross-hairs and centered in the FLIR display.

CDIP MODE HUD SYMBOLOGY

CDIP Mode is visually controlled and actuated through the HUD. Therefore, a number of cues are displayed on the HUD to aid in the delivery of the priority weapon.

If a target has been designated (not required) it is marked by the **TD** symbol. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you to it. (It works in the same manner as a Sequence Point caret).

In the lower right corner the "CDIP" mode indicator is displayed, along with the **Ground Range to Target (G)** and the **Time to Target (TTGT)** or **Time to Release (TREL)** if a target is designated. Both TTGT and TREL are expressed in minutes and seconds; the first value is minutes and the second value is seconds. If the designated target is behind your F-15E, TTGT is displayed, otherwise, TREL is displayed.

The Range to Target is measured somewhat differently than you may be accustomed to. It is measured in only two dimensions. It is as if your F-15E was positioned flat on the ground and you were driving it, like a tank, to the target.

The current computed impact point is indicated by the Target Reticle, which is positioned at the bottom of the **Displayed Impact Line (DIL)**. Think of the DIL as a steering line; it is there to help you line up the target.

CDIP MODE WEAPON DELIVERY

In CDIP Mode, the **Target Reticle** always marks the point of impact on the ground. Use the DIL to orient and stabilize your flight path; the DIL should be positioned to cut directly through the center of the target.

When the Target Reticle encircles the target (TREL should read zero with a designated target), press the ***Pickle Button*** **(spacebar key or Joystick button #2).** The weapon "in priority" is immediately released.

The fact that CDIP does not require a designated target allows you to immediately attack any target of opportunity. Just line up the shot and pickle the weapon.

CDIP LASER MODE

CDIP Laser Mode is utilized for the pinpoint delivery of GBU-10 and GBU-12 Laser Glide Bombs, and works hand-in-hand with the Targeting FLIR. It requires that you designate the target prior to launch.

CDIP Laser Mode is an all-weather delivery method that constantly computes the release time of the GBU-10s or GBU-12s based on the position of the designated target. These weapons are not powered, so their range is more limited than an AGM-64D Maverick at low altitude.

LASER DELIVERY MODE HUD SYMBOLOGY

Laser Delivery Mode can be actuated through the HUD. Therefore, a number of cues are displayed on the HUD to aid in the delivery of the priority weapon.

The designated target (required in this case) it is marked by the TD Symbol. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you to it.

In the lower right corner the "CDIP" mode indicator is displayed, along with the Ground Range to Target in nm (G) and the Time to Target (TTGT) or Time to Release (TREL). If the designated target is behind your F-15E, TTGT is displayed, otherwise, the TREL is displayed.

The designated target is marked by the TD Symbol. Additionally, the Laser Diamond is superimposed over the Gun Cross at the top of the HUD. This provides visual information as to the status of the laser.

LASER DELIVERY MODE TARGETING FLIR SYMBOLOGY

The designated target is marked by cross-hairs. When the designated target is within firing criteria, "LASE" appears at the top right side of the FLIR display along with a flashing "L" in the lower right corner.

LASER MODE WEAPON DELIVERY

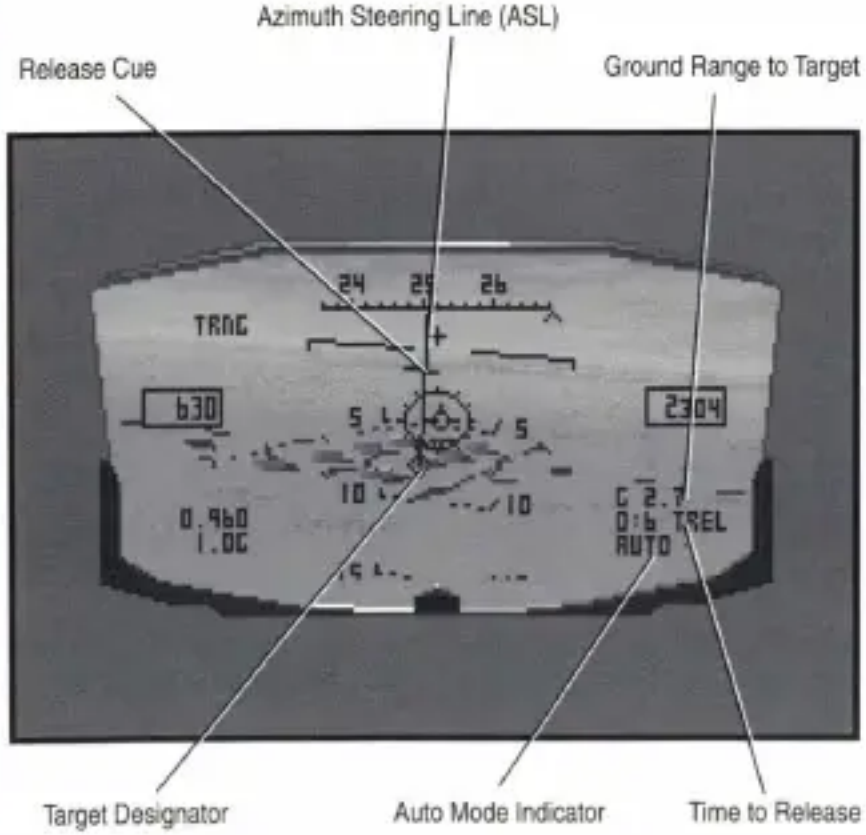
In Laser Delivery Mode, it is purely a matter of placing the designated target somewhere out in front of your F-15E. When the GBU-10 or GBU-12 is in range and the target is in the frontal arc of your F-15E, the HUD and Targeting FLIR both provide visible launch indicators.

When the target is in constraints, the Laser Diamond on the HUD starts to flash. The FLIR displays "LASE" in the upper right corner and a

flashing "L" appears in the lower right corner. All of these cues indicate that the laser designator is currently painting the target; the active weapon may now be launched. It is not necessary to wait for TREL to reach zero before released the ordnance.

IMPORTANT: Your F-15E must continue to lase the target until the GBU-10 or GBU-12 impacts. GBU-10s and GBU-12s have a terminal velocity of approximately 400 kts. If your airspeed is faster than the bomb's airspeed, you could overfly the target before the bomb impacts. If you are not able to continually lase the target, the bomb goes ballistic and may or may not hit the target.

AUTO BOMBING MODE HUD



AUTO MODE

AUTO Mode is a computed, automatic initiated release mode for the delivery of all types of free-fall bombs and laser glide bombs (see CDIP Mode for types). It constantly computes the release time of the priority weapon based on the position of the designated target.

AUTO Mode indicates a steering cue to line up the target and a cue when to pickle the weapon; it then automatically releases the weapon at the appropriate time. Bombing targets does not get much simpler than this.

AUTO MODE HUD SYMBOLOGY

AUTO Mode is controlled and actuated through the HUD. Therefore, a number of cues are displayed on the HUD to aid in the delivery of the priority weapon.

The designated target is marked by the **TD** symbol along with the **Azimuth Steering Line** (**ASL**) leading up from it. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you to it.

In the lower right corner, along with the "AUTO" mode indicator, are displayed the **Ground Range to Target (G)** and the **Time to Target (TTGT)** or **Time to Release (TREL)**. See CDIP for explanation of these indicators.

AUTO MODE TARGETING FLIR SYMBOLOGY

The designated target is marked by cross-hairs.

AUTO MODE WEAPON DELIVERY

In AUTO Mode, the Target Reticle always encircles the Velocity Vector. Use the ASL to orient and stabilize your flight path. The Target Reticle should be "driven" to cut directly through the center of the ASL.

At approximately 10 seconds prior to release, the **Release Cue** appears on the ASL above the TD symbol. This is a small horizontal bar that marches down toward the TD symbol. At or near the point the Release Cue appears, you should press and hold ***Pickle Button*** **(spacebar key or Joystick Button #2)**. When TREL reaches zero, the priority weapon automatically releases.

If you hold the Pickle Button down longer than is required, the target reticle begins flashing to remind you to let up. You cannot release additional ordnance by holding the Pickle Button down longer. You must first release it then press down on it again with the drop cue.

AUTO LASER MODE

AUTO Laser Mode is utilized for the pinpoint delivery of GBU-10 and GBU-12 Laser Glide Bombs, and works hand-in-hand with the Targeting FLIR.

AUTO Laser Mode is an all-weather delivery method that constantly computes the release time of the GBU-10s or GBU-12s based on the position of the designated target. GBU-10s and GBU-12s are not powered weapons, so their range is more limited than a AGM-64D Maverick at low altitude.

LASER DELIVERY MODE HUD SYMBOLOGY

Laser Delivery Mode can be actuated through the HUD. Therefore, a number of cues are displayed on the HUD to aid in the delivery of the priority weapon.

The designated target (required in this case) it is marked by the TD Symbol. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you to it.

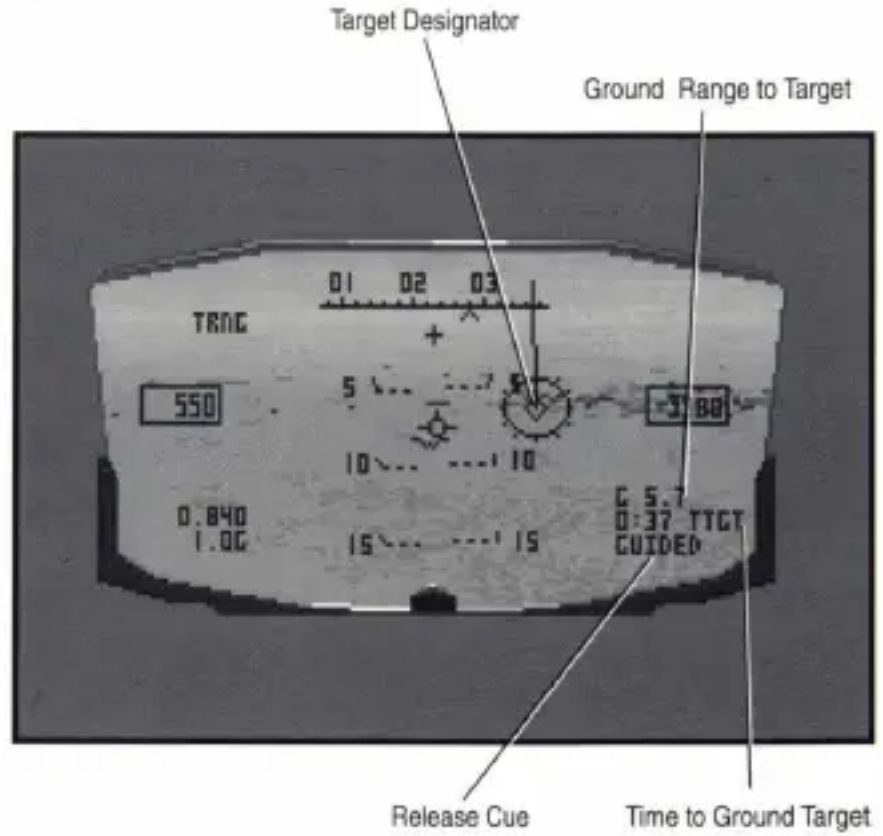
In the lower right corner the "AUTO" mode indicator is displayed, along with the Ground Range to Target in nm (G) and the Time to Target (TTGT) or Time to Release (TREL).If the designated target is behind your F-15E, TTGT is displayed, otherwise, TREL is displayed.

The designated target is marked by the TD Symbol. Additionally, the Laser Diamond is superimposed over the Gun Cross at the top of the HUD. This provides visual information as to the status of the laser.

LASER DELIVERY MODE TARGETING FLIR SYMBOLOGY

The designated target is marked by cross-hairs. When the designated target is within firing criteria, "LASE" appears at the top right side of the FLIR display along with a flashing "L" in the lower right corner.

GUIDED DELIVERY MODE



GUIDED DELIVERY MODE

Guided Delivery Mode is a computed, automatic initiated release mode for the delivery of self-guiding weapons including: AGM-65D Maverick, GBU-15, AGM-84E SLAM, AGM-84A Harpoon, and AGM-88C HARM.

Guided Mode is an all-weather bombing mode that hands off the designated target to the built-in, self-guiding logic systems of the priority weapon. Guided Mode indicates a cue when the priority weapon has acquired the designated target. Just press the ***Pickle Button*** **(spacebar or Joystick Button #2)** and move on to bigger and better things. These fire and forget weapons guide themselves to the target.

GUIDED MODE TARGETING FLIR SYMBOLOGY

The designated target is marked by cross-hairs.

GUIDED MODE HUD SYMBOLOGY

Guided Mode can be controlled and actuated through the HUD. Therefore, a couple of cues are displayed on the HUD to aid in the delivery of the priority weapon.

The **Target Reticle** appears in the center of the HUD encircling the velocity vector. The designated target is marked by the **TD** symbol along with the **Azimuth Steering Line (ASL)** leading up from it. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you toward it.

In the lower right corner are displayed the **Ground Range to Target** (**G**) in nm and **Time to Target** (**TTGT**). See CDIP for explanation of these indicators.

GUIDED MODE WEAPON DELIVERY

In Guided Mode, it is purely a matter of bringing the active weapon into constraints. These weapons have a narrower field of view than your HUD; use that as an indicator. When the active weapon is in constraints, the HUD and Targeting FLIR both provide visible indicators.

When the target is in constraints, "GUIDED" is displayed in the lower right corner of the HUD and the Target Reticle snaps to encircle the TD symbol. The Targeting FLIR displays "IN RNG" (in range) along the right side of the display. Both of these cues indicate that the active weapon may now be launched.

There are two special case guided weapons: the AGM-84A Harpoon and AGM-88C HARM.

The Harpoon is an anti-ship missile and therefore only guides on ship-type targets. Therefore, care should be taken to only launch a Harpoon against naval targets, i.e. ships. The AGM-88C HARM anti-radiation missile homes in on radar energy generated from a radar source. The HARM should only be designated against an enemy radar source. This can be accomplished from either the RBM/HRM or Targeting FLIR.

GUIDED DELIVERY LOCK-AFTER-LAUNCH

The GBU-15 and AGM-84E SLAM weapon systems have the added capability of locking onto a different target after launch. Since the image presented through the Targeting FLIR for GBU-15 and AGM-84E SLAM is the weapon's point of view as opposed to the F-15E's point of view, any target in the FLIR's field of view can be designated.

The normal procedure for designating targets through the Targeting FLIR is utilized. This can be changed any number of times prior to the weapon impacting the ground. This is an especially useful function with the AGM-84E SLAM due to its long range. This stand-off capability can be used to fly the missile into the general area of the target, and then to re-designate the actual or key target.

BREAK X

Releasing ordnance requires that your aircraft remain within certain flight parameters. For example, you would not want to release bombs while flying inverted or in a steep bank. If at any time you attempt to drop bombs from a prohibited flight attitude, you receive a Break X symbol.

When launching air-to-air missiles, a Break X symbol means that the target is too close. When releasing air-to-ground ordinance, the Break X means that your aircraft is in a flight attitude that prevents bombs from coming off their weapons stations cleanly. You will have to assume a different profile in order to release your ordnance.

AIRCRAFT DAMAGE

On every mission you face a threefold threat from enemy aircraft, Surface-to-Air Missiles (SAMs) and ground fire. Luckily, you have counter-measures available to defeat each of these threats. Even so, there are times when the enemy may catch you by surprise and score a hit.

There are 16 different areas (and systems) on your aircraft that can potentially be damaged during the course of mission. Some of these areas, such as hits to the Nav/ILS system, are not as critical as others. Hits which damage your hydraulic system or engines should be viewed more seriously.

Damage to your aircraft is accessed according to the Difficulty Level you initially chose. It is also dependent on what type of weapon hits you. For example, radar-guided missiles with their exceptionally large warheads do considerably more damage than heat-seekers. A missile hit is quite capable of causing damage to multiple areas. At the higher Difficulty Level settings, a single hit could conceivably knock out enough systems to render your aircraft unable to continue the mission.

Ground fire is the least effective of all in terms of doing damage, but remember the "golden BB" theory. It only takes that one-in-a-million hit in the right place to end your mission.

DAMAGE ASSESSMENT

If your aircraft is damaged, it may not be immediately apparent what is wrong. The aircraft may just feel sluggish and unresponsive. To ascertain the exact nature of the damage, you must call up the Master Caution display for a text read out of the damaged areas. Note that if the displays themselves are damaged, this may not be possible.

If the MPD/MPCDs are damaged there is a secondary means of determining damage. The WSO has a visual checklist of damaged areas in the form of two rows of Caution Lights overtop his MPD/MPCDs. When these lights are illuminated, it indicates damage to that particular system.

When an area (system) is damaged it basically means that it is inoperable for the remainder of the mission. (For a more detailed explanation of the individual systems, see the *Authentic Mode* Aircraft Damage section and summary).

STANDARD MODE CHECK RIDE

The *Standard Mode* Check ride is designed to help you understand *Standard Mode* flight and combat procedures. It explains some basic new features and flight commands that were not covered in the Quick Start section.

To get the most from this Check Ride, have the Key Reference Card handy. It is also recommended that you fly this first mission using the Training mode option. This way you are invulnerable to enemy fire that may prematurely end the lesson.

GENERATING THE CHECK RIDE MISSION

Before flying this *Standard Mode* Check Ride, you have to first generate a mission. The theater and type of mission are unimportant. Choose any you like. Since mission assignments are handed out in the Briefing Room you must first go to the Home screen hangar area. Set up a mission according to the instructions contained in the **Home Screen** section of this manual. For purposes of this Check Ride though, be sure to set all the Reality options to either *Standard Mode* or ON.

After receiving your mission, exit the Briefing room into the Arming Screen. Select AIM-120 AMRAAMs and AIM-9M Sidewinder missiles. Because these missiles are essentially "fire and forget," they are easiest to use. Equip your aircraft with either Maverick missiles or Mk. 82 500 lb. bombs. Since these weapons use Guided and CDIP delivery modes, bombing procedures will be less difficult to understand for your first time out. In *Standard Mode*, weapon effectiveness is not an issue, so both Mavericks and Mk. 82s are able to destroy any target they hit.

BEGINNING THE MISSION

In Difficulty Level 1, you begin in-flight overtop a friendly airbase. Your aircraft begins pointed at the assigned Primary target. The Primary target begins the mission pre-designated.

At Difficulty Levels other than 1, you begin a mission either at a friendly airbase or already in-flight, having been fully fueled from a KC-10 tanker. If airborne, your aircraft is already in level flight and ready to begin the mission. If the mission begins at a friendly airbase, you obviously can't go anywhere until you takeoff.

If you begin at a friendly airbase, take a deep breath and prepare yourself for takeoff. When ready, fire up your engines. This is accomplished by tapping ***Accelerate* (= key)** a few times. Notice that the engine noise increases as you accelerate. You begin the simulation properly aligned on the runway centerline so there is no need to worry about rolling off the edges.

Notice that you are accelerating down the runway. The small rectangle on the left of your HUD shows your airspeed increasing, your altitude remains at zero feet until you lift off the runway. Continue to accelerate by tapping the ***Accelerate* (= key)** until reaching 100% power.

You need all the power your engines are capable of producing during takeoff. Note that you may use the ***Max Accelerate* (shft= Key)** to immediately accelerate to full power rather than tapping the ***Accelerate* (= Key)** numerous times. Get in the habit of pressing ***Afterburner* (a Key)** when taking-off.

When your airspeed reaches a minimum of 150 knots you should see the Velocity Vector begin to rise. This is an indication that you are ready to gently pull back on your *Controller* and lift the nose wheel off the runway. At 170 knots, you have built up sufficient airspeed to lift off the runway and begin climbing. Of course, these numbers are to be used as a general guide only. With ordnance on board, the F-15E naturally requires additional speed to produce the lift needed for takeoff.

Now that you are airborne, notice the numbers inside your altitude rectangle increasing. Notice also that your airspeed is very low during takeoff, so don't perform any wild maneuvering or you risk "stalling" the aircraft.

CLIMBING OUT

Once you are safely off the runway, raise your landing gear by tapping the ***Landing Gear* (g key)**. In Difficulty Level 1, your Weapon Systems Officer automatically raises the gear for you after reaching an altitude of 100 feet. With landing gear extended, you experience a mild level of turbulence at low altitudes.

In the lower left corner of the HUD, your current Mach number and g-force being produced by your maneuvers are displayed. You only receive this information when your landing gear is raised.

To climb for altitude, slowly pull back on the *Controller*. Align the Velocity Vector with the 10 degree pitch line that appears in the center of your HUD. Your airspeed will gradually build while maintaining this constant 10 degree "angle of attack." This gives you a steady rate of climb without risking a "stall condition."

Although you may climb to any altitude you desire before leveling off, for purposes of this Check Ride, let's climb to an even 8,000 feet. This gives you plenty of time to experience the aircraft in a climb profile. You have time during the climb out to enjoy some of the external views. The ***Side View* (F6 Key)** in particular, gives you a great view of your pitch attitude.

LEVEL FLIGHT

After climbing to 8,000 feet, your next step is to achieve level flight. From your 10 degree angle of attack, use your *Controller* to drop the nose of your aircraft so that the Velocity Vector is aligned with the solid horizon line on the pitch ladder.

Continue to make fine-tuning adjustments until your altitude indicator is neither gaining nor losing altitude. You have reached level flight. Again, use one or more external view keys to get a picture of what the aircraft looks like in level flight.

TURNING THE AIRCRAFT (BANKING)

Turning your aircraft is known as "banking." Move the *Controller* either left or right gradually and watch as the aircraft begins to turn in that direction. Notice that the pitch ladder inclines toward the opposite direction as you turn. A close inspection of the pitch ladder reveals that this is because the solid pitch horizon line continues to be aligned on the horizon.

To turn faster, pull back on the stick. Keep an eye on your airspeed (on the left of the HUD) and altitude (on the right). A tight turn with back-pressure on the *Controller* turns you much more quickly, but can slow your aircraft. The sharper the turn, the more g-forces are exerted by your aircraft as shown on the g-force indicator in the lower left of your HUD.

Here's an old trick that student pilots learn in flight school to practice turning. It's called **Turns around a Point**. Pick an object on the ground such as a tower or road intersection. Use your ***Pilot View* (F4 Key)** to focus your view on that point. Now, bank your wings and concentrate on performing a shallow turn around the point on the ground you've selected.

The idea is to maintain a steady turn rate around the point. Your turn should make a perfect circle on the ground beneath you. If you end up closer to the point than when you started your turn, try it again. Start by making gentle turns without adding back-pressure on the *Controller*. Now do a few tight, high-g turns by pulling the stick back toward you. Notice the difference, you are able to make complete circles using much less airspace.

FLYING ON COURSE

Now it's time to get onto the right course. Look at the horizontal scale across the top of your HUD. This is known as a ***Heading Indicator***. The number directly in the center of the scale corresponds to your current heading in degrees.

There is an inverted -V symbol underneath the scale. This inverted -V symbol is known as the Sequence Point *caret*. It indicates the heading you must fly to reach your active destination (Sequence Point). By turning the aircraft, you can align the Sequence Point caret with the center of the heading indicator.

When the symbol is centered, it indicates that you are on course toward your active Sequence Point. For purposes of this check ride, it is only important that you become familiar with the Sequence Point caret and Heading Indicator functions.

To assist you in maintaining the proper heading, press ***Automatic Pilot*** **(a Key)**. The Automatic Pilot places your aircraft on the correct heading toward your active Sequence Point and keeps it there.

ENJOYING THE FLIGHT

Now that your aircraft is on course with the Automatic Pilot engaged, you can settle down. Take this time to find the various ***Simulation Views*** **(F1-F10 Keys)** on the Key Reference Card. You can observe the scenery and your aircraft by using the various *Simulation Views* (F1- F10 Keys) available to you.

There are fields of vision out the front, rear, and sides of the aircraft plus a number of external views. You can even switch to the back seat and manipulate the views from that perspective. The ***Normal Cockpit View*** **(F1 Key)** returns you to the front seat of the cockpit at any time.

AIR COMBAT (FLYING OFFENSIVELY)

Your F-15 is equipped with two different types of missiles: **radar-guided** and **heat-seeking** missiles. Radar-guided missiles come in two types: medium-range AIM-120A AMRAAMs and AIM-7M Sparrows. The Eagle only carries the latest model heat-seeking AIM-9M Sidewinders. You are able to select which of these missiles are in priority by pressing either ***Short Range Missile*** **(2 Key)** or ***Medium Range Missile*** **(3 Key)**.

It is a good idea to place your medium range missiles "in priority." (Placing a weapon "in priority" means selecting that weapon to be fired). Press ***Medium Range Missiles*** **(3 Key)**. With your radar-guided missiles ready you now have created a triple-layered defense which is difficult for an enemy aircraft to penetrate.

Your first line of defense are your medium range "fire and forget" AIM-120 missiles. Enemy aircraft can be targeted and engaged at a distance. If an opposing interceptor gets past your radar-guided missiles, your next line of defense is shorter-ranged, heat-seeking Sidewinders. Your third and final line of defense is the 20mm Vulcan gun. In modern air combat, a gun is a weapon of last resort, so never fly with your guns in priority if you have missiles remaining. Besides, you may always fire your guns even if you have a missile in priority.

AIR COMBAT (FLYING DEFENSIVELY)

In the previous section on air combat you learned how to use your radar and missiles to destroy opposing interceptors. In this section the emphasis is on defensive tactics that help keep you from being just another statistic.

In *Standard Mode*, the TEWS gives you a more than adequate view of the tactical situation surrounding your aircraft. This view extends out 80 nm in all directions which by coincidence is also the maximum of your radar. Therefore, keep your use of radar down to a minimum. By using your radar sparingly, you cut down on the amount of detectable energy emanating from the aircraft (EMIS).

Use the excellent intelligence provided by the TEWS to avoid heavy concentrations of SAM batteries and radars. The TEWS also gives you visual clues as to which direction enemy aircraft are facing. By staying low with the radar in SNIFF mode, you should be able to sneak up on enemy aircraft before they can detect you.

Perhaps the best defensive tactic to learn concerning enemy aircraft is simply to stay away from them altogether. The TEWS makes this easy. Remember your mission is to hit ground targets. Your Primary and Secondary targets generate the most points as far as scoring goes, so why risk your aircraft unnecessarily?

In the event an enemy aircraft is able to close on you and launch a missile, you still have a number of options available to you. Try to turn

inside the missile and shake it off your tail. If maneuvers fail, begin dropping ***Chaff* (c Key)** and ***Flares* (f Key)**. These counter-measures (ECM) serve to decoy missiles away from your aircraft. You can watch the effect your ECM has on enemy missiles on the TEWS.

You cannot win an air combat by flying defensively, you can only achieve a tie. You must at some point in the fight be able to turn the tables on your attacker. Switch to ***Short-range missile* (2 Key)** or even ***Guns* (1 Key)** once the combat gets up close and personal. Keep your opponent in sight using ***Padlock View* (F8 Key)** and seek to take advantage of his mistakes. Two quick pointers; 1) never fly straight and level for more 10 seconds at a time and, 2) alternate your speed by applying afterburner and speedbrakes.

Surface-to-Air missiles require an entirely different approach to defensive flying. Again, the best way to beat a SAM is to avoid its radar controller or GCI. Radar guided SAMs are totally dependent upon guidance so if you can avoid being detected the SAMs will remain on their launchers.

If you are detected, remain low and fast. You might not outrun a SAM but you may be able to use the natural terrain as a shield. The mountains and valleys of central Korea are perfect for this. The flat desert terrain in Iraq presents more of a challenge.

Use your internal Jammer. The Jammer works to interfere with a radar's ability to track and lock-on your aircraft. Since SAMs need guidance from ground radar, your Jammer suppresses the enemy's ability to launch missiles.

The TEWS gives you the ability to spot incoming missiles. Use the TEWS in conjunction with the maneuvers described in Chapter 3 to outwit any missiles that manage to get launched in spite of your jamming. Not all missiles are alike, however. Pay attention to the type of missile coming your way. SA-2 "Guideline" missiles are easily outmaneuvered whereas SA-5s are a different story.

ATTACKING GROUND TARGETS

After dealing with any enemy fighters coming up to stop you, the way is now clear to perform your assigned mission: ground attack. Air-to-Ground combat is best conducted from the back seat of the aircraft. This way you have four MPDs at your disposal and constantly in view.

Switch your view to the WSO's perspective in the back seat using the ***Front/Back Seat* ('Key)**. Set the MPD/MPCDs views that best accommodate target acquisition and delivery mode for the ordnance you're carrying. There are several different ways to designate targets; HRM, Targeting FLIR, HUD Target designator and HUD Pipper designator. Some ordnance requires that a certain type designator be used but for the most part, the method of target designation is up to you.

Once a target has been designated, there are three primary delivery methods; **Guided**, **AUTO Mode**, and **CDIP Mode**. **Laser** delivery is actually a subset of AUTO and CDIP. Each of these methods best serves a particular family of ordnance as follows:

Guided Delivery Mode: Guided delivery is used in conjunction with self-guiding weapons such as the AGM-65 Maverick, Harpoon, SLAM, and GBU-15 and HARM. Once a target is designated and brought within the weapon's constraints, all that is required is to fire the weapon. The weapon guides itself to the target without further help from you.

Since these weapons are "fire and forget," launch them and move out smartly. Don't hang around to watch. It's not necessary and it exposes your aircraft to enemy fire for no reason. If you just want to see the explosion, switch to a rear view and watch while you're on your way home. With self-guiding weapons the rule to remember is: "Shoot and Scoot."

Laser Delivery Mode: Laser delivery is used in conjunction with GBU-10 and GBU-12 bombs. It is particularly useful at night when other optical systems are less effective. The Laser designation is generated by the Targeting FLIR which gives you launch cues when the target is within range.

Because the GBUs are not powered, the range of this delivery method is limited to the range of the FLIR (10 nautical miles). Laser delivery also requires that you continue to designate the target right up until impact. This is somewhat more risky than Guided mode. You are required to fly right into the teeth of enemy fire and stay there until the bombs hit.

AUTO Designation Mode: AUTO mode is best used when carrying free-fall bombs such as MK. 82s, Mk. 84s, Durandals, etc. These unpowered, unguided munitions are referred to as "dumb" bombs. Aptly named, these weapons simply fall off your aircraft when released and hit the ground according to the laws of physics.

AUTO mode facilitates dropping "dumb" bombs by displaying a Azimuth Steering Line (ASL) extending from the designated target. Line up your aircraft's heading with the ASL. A horizontal release cue bar gradually drops down the ASL toward the target reticle. When the Time to Release (TREL) reads under 10 seconds hold down the ***Pickle Button* (spacebar).** The ordnance is automatically released at the proper moment.

The drawback to AUTO mode is that once your aircraft is lined up with the ASL, you're required to maintain that heading until the bombs are released. Flying straight and level over a heavily defended target could prove hazardous.

CDIP Mode: This delivery mode is used with the same ordnance as is used with AUTO Mode. It is a manual delivery system that leaves decisions up to the pilots's discretion. All that is required is that the intended target by located within the target reticle when the ordnance is released.

CDIP has both good and bad features. On the positive side, you are not required to designate targets before attacking them. CDIP allows you to drop bombs on targets of opportunity as you spot them. It is a completely passive delivery method which is undetectable.

On the negative side, it is the least accurate of all delivery methods. Because it does not use guidance systems, accuracy depends entirely on the pilot's eye. Darkness makes using this optical mode somewhat more difficult as well. It requires practice to get good at using this method.

RETURNING HOME AFTER THE MISSION

After one or both targets are attacked, it's time to come home. Chances are that your mission has attracted a good deal of attention. Don't fall victim to the *Get Home Syndrome*. That is, concentrating on getting home in a hurry and failing to notice enemy interceptors lining up on your tail. Take a minute to judge the situation and pick out only the enemy aircraft that have a possibility of catching you. Concentrate on destroying them with your remaining air-to-air ordnance on the way.

Another important consideration is your fuel status. Be sure to check the amount of fuel you have remaining on the EMD. The straight shot home might not always be the safest. If fuel allows, deviate your course to avoid heavy concentrations of enemy ground forces. If you are low on fuel, the shortest route home is a straight line. The automatic pilot is an excellent way to find the quickest route.

To return home, simply toggle the ***Next Sequence Point +* (s Key)** until you see "home airbase or tanker track" appear above your HUD. Note that the Sequence Point caret has changed to a new position underneath your heading indicator. This shows you the straightline heading you need to fly in order to return to your base.

Now engage the automatic pilot by pressing ***Automatic Pilot* (p Key)**. "Automatic Pilot On" appears at the top of the HUD once the Automatic Pilot is engaged. The aircraft is now put on a heading which brings it back to base.

Remember, you can either use the Automatic Pilot or manually fly the plane home. For purposes of this Check Ride, however, let the automatic pilot do the work for you. That's what it is there for.

LANDING

In Difficulty Level 1, you are not required to actually land the aircraft. All that is required is that you get the aircraft over the airbase. It is then "grabbed" and placed on the runway for you.

In *Standard Mode* when playing under Difficulty Levels 2, 3,and 4, the automatic pilot is able to land the aircraft without human assistance. For the first couple missions, it is probably better to let the automatic pilot land the aircraft for you. Pay close attention to the relationship between airspeed and altitude during the landing procedure. Watch how the Automatic Pilot performs the landing once or twice before attempting it yourself.

If you are adventurous and want to land the aircraft yourself, the key is to begin early. Once the airbase is in sight, it is probably too late to start thinking about landing. You never have enough hands to perform all the last-minute tasks needed to land an aircraft, so start preparing while you are still many miles away.

All ground runways are oriented North-South (360 °-180 °). Because airbase traffic patterns are one-way (just like traffic on the ground) your approach should always be from the south. In other words, takeoff and landings should always be performed south to north on a heading of 360 °.

Although you may land the aircraft "against traffic," courteous pilots will take the time to do it right. Always watch out for other aircraft in the traffic pattern. You may not hit them, but you'll sure scare the heck out of anybody in the traffic pattern..

Landing an aircraft is simply being able to manipulate airspeed and altitude in order to reach zero/zero; ending up on the runway at 0 knots and 0 altitude. When performing manual landings, you will have to judge these things for yourself.

Step one is to line up properly with the runway while you are still at least 15 nautical miles away. Begin your approach around 1,000 feet. This gives you some useable altitude in case of an emergency while on "final."

Maintain a straight and level approach to the runway while slowly reducing your engine power setting to 50%. Keep an eye on your altitude while your airspeed bleeds off. You want to begin a **gradual** descent. At no time do you want to dive at the runway. The nose of the aircraft should always remain slightly pitched up. This nose-high attitude the aircraft assumes when landing is called a "**flare**."

Remember, the idea is to glide in and not fly into the runway. You should be continually losing altitude throughout your approach without having to dip the nose of the aircraft. If you find yourself losing altitude too rapidly, increase your power by 10%. If you are descending too slowly, you are probably travelling too fast. Extend your ***Brake* (b Key)** or decrease your power setting. The closer you come to the runway, the slower you want to be moving.

As you cross over the threshold (painted area at the end of the runway), aim for an altitude of less than 200 feet and an airspeed of 145-165 knots. If your aircraft begins to stall, bump up your airspeed so that you are flying just above stall speed. "Flare" the aircraft (pitch the nose up) so that the first thing to touch the ground are the rear wheels.

Try to touch down in the first half of the runway so that you'll have room for a roll-out. When your wheels touch the runway, cut the Throttle and make sure your Brake is engaged. Check for the [**B**] Instrument light in the Cockpit and press ***Brake* (b Key)** if it is not engaged. Once you have come to a full stop, the Control Tower also calls to indicate you have made a safe landing.

INSTRUMENT LANDING SYSTEM (ILS)

The F-15E is equipped with an Instrument Landing System (ILS) that is tied directly into the navigation system. This ILS is designed to assist you in lining up with a runway and determining the proper glide slope for landing.

Each friendly airbase is equipped with an ILS beacon which projects an electronic (Localizer) beam away from the runway. The beam is exactly aligned with the runway's heading so that an aircraft riding the beam is properly lined up to land. The beam is elevated so that it also assists in setting a glide slope.

USING THE ILS

The ILS is only activated under certain circumstances. First, the aircraft must be in NAV Master Mode. Your landing gear must be extended and your aircraft must be within 20 nautical miles from a friendly airbase. The primary means of viewing the ILS is through the pilot's HUD. However, the ILS may also be used in conjunction with the ADI and HSI displays if necessary.

The ILS consists of a Bank Steering Bar and Glide Slope Indicator. These two bars (vertical and horizontal lines) move left and right, up and down according to your current position on approach. When you are properly lined up on the glide path, these two bars meet to form cross-hairs in the center of your HUD.

BANK STEERING BAR (VERTICAL BAR)

The Bank Steering Bar is a visual cue that indicates your aircraft's position in relation to the runway. If the bar is located left of center in the HUD, your aircraft's course is right of the runway. If the bar is located right of center in the HUD, your aircraft's course is left of the runway.

To get on course, alter your aircraft's heading in the direction of the bar. As you turn, the bar begin's to center itself on the HUD. Make minor course corrections to keep the vertical bar centered. As long as the bar is centered, you are on the proper course for landing.

GLIDE SLOPE INDICATOR (HORIZONTAL BAR)

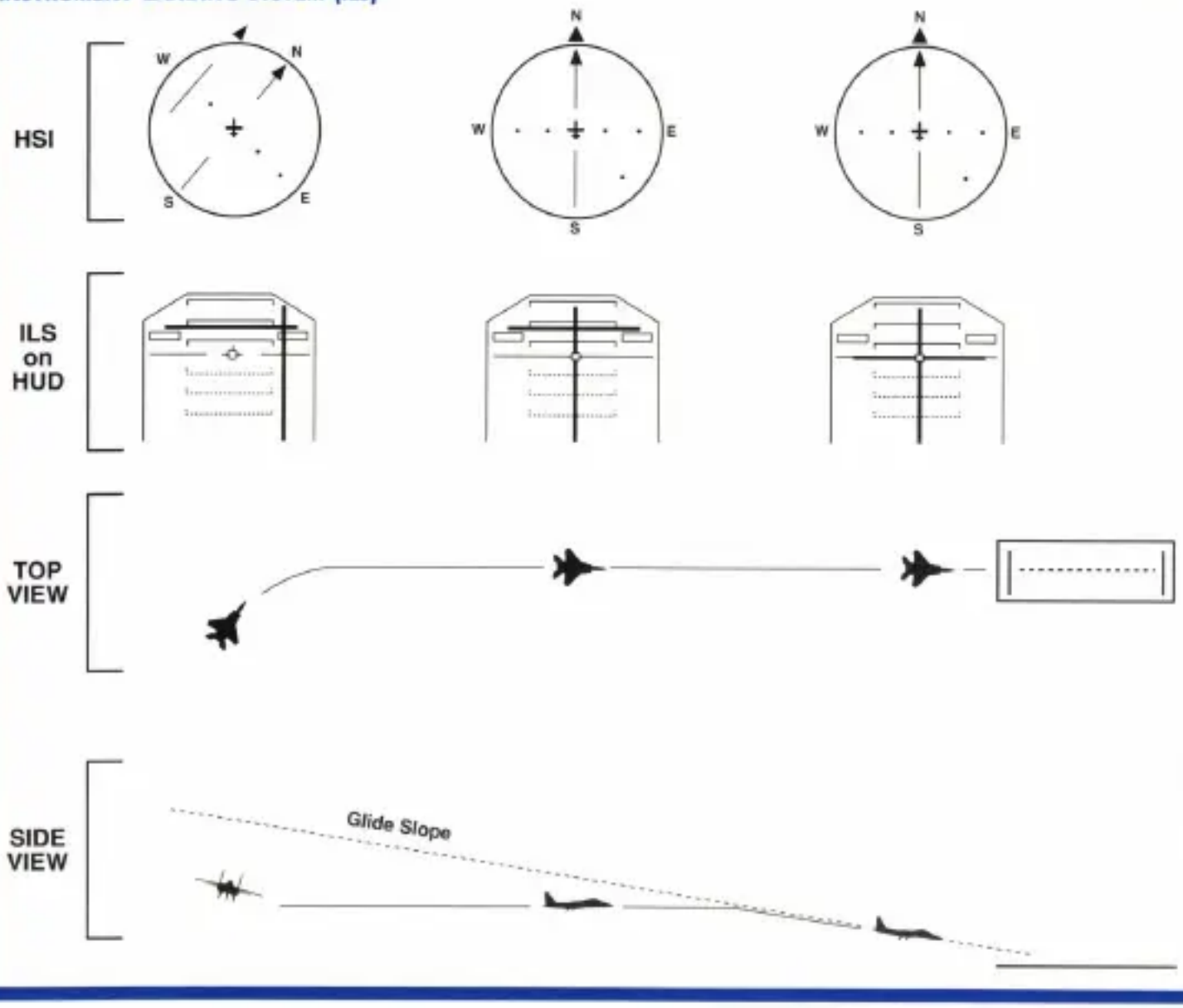
The Glide Slope Indicator is a visual cue that indicates your aircraft's proper altitude in relation to its distance from the runway. Naturally, the closer you get to the runway, the lower your aircraft should be. The altitude and distance relationship sets up a safe glide angle.

If the horizontal bar is above center on the HUD, your aircraft is too low. Conversely, if the bar is below center, your aircraft is too high. In order to stay on the glide slope, you must gain or lose altitude accordingly. Having reached the proper altitude, keep the bar centered to remain within the glide slope.

A good rule of thumb is the nearer you are to the runway, the lower you have to be on the glide slope. If you find yourself too low in the glide slope, you have the option of maintaining your current altitude. As you get nearer the runway, the glide slope indicator begins dropping until you are once again properly aligned.

Note that you should perform ILS assisted landings in conjunction with the symbology displayed on the HSI. Rather than repeat that information here, refer back to the MPD/MPCD section HSI listing for details.

INSTRUMENT LANDING SYSTEM (ILS)



CONGRATULATIONS! YOU'VE SUCCESSFULLY COMPLETED YOUR STANDARD MODE CHECK RIDE. NO DOUBT YOUR "WIZZO" IS ALSO GLAD YOU MADE IT BACK!

VIII. AUTHENTIC MODE

The *F-15 Strike Eagle III* design team anticipates that many players will wish to start playing the simulation in *Authentic Mode* settings. It is strongly recommended that you learn *Standard Mode* play initially and then graduate to this higher level of difficulty.

Despite this recommendation, the following *Authentic Mode* section is presented as a stand-alone portion of instruction. Applicable *Standard Mode* instructions are repeated here so that it is not necessary to read the preceding *Standard Mode* section first.

If you have read the *Standard Mode* instructions, carefully re-read the instructions in this section. Do not be confused by the frequent repetition. In some instances, the differences between the modes are subtle.

Because *Authentic Mode* is more challenging, you are rewarded by higher point scores for successfully completing your missions. It is as close to flying an actual F-15E as most of us are likely to get.

AUTHENTIC MODE REALITY OPTION SUMMARIES

For those of you who have read the *Standard Mode* instructions, the following list of Reality options summarizes the differences between the two modes.

1) **Flight Model:** The *Authentic Mode* flight model is a true simulation of the actual F-15E flight envelope. It differs greatly from *Standard Mode* and takes into account such things as weight and drag coefficients. Until now, there was really no reason to jettison ordnance prior to engaging in air-to-air combat. Your aircraft performed equally well loaded as unloaded. Not anymore.

Total gross weight (airframe, fuel and weapons) combined with a hot ambient (outside) air temperature will cause even the most advanced aircraft to perform like a "pig." A heavy aircraft performs like a person with excess weight, lethargic and slow. As it trims down (burns off fuel) it becomes much more responsive. In short, don't expect a fully loaded Eagle to perform like a clean one.

Once the bombs are off, induced and parasitic drag are greatly reduced. Free of all that excess weight, your machine will run like the hot fighter you want it to be. Keep these general principles in mind when flying the *Authentic Mode* flight model. If you try to cut corners, chances are you will find yourself needlessly stalling the aircraft and not being able to recover.

The *Authentic Mode* flight model forces you to take these factors into consideration. The afterburner becomes a necessity when trying to takeoff fully loaded. The additional thrust produced shortens your takeoff roll and assists the aircraft become airborne more quickly.

A heavy aircraft will accelerate slower and use more runway to takeoff. It may at times require more runway than is available. If anything should go wrong (blown tire, engine failure, etc.) a heavy aircraft takes more time (and distance) to come to a halt.

One other feature added to this flight model is the affect of high-g forces maneuvers on the pilot. Positive g-forces cause temporary pilot blackouts giving the enemy a perfect opportunity to shoot you while you're sleeping. Negative g-forces tend to cause pilot "redouts" due to excess blood being forced into the upper body. These effects tend to limit your ability to perform maneuvers even though the aircraft is perfectly willing to do more.

2) **Air-to-Air Radar:** A number of very important changes have been made to the Air-to-Air radar. So many in fact, that only a few major differences are mentioned here.

Instead of one just one STD display, searching for enemy aircraft has been divided into two new modes: Long Range Scan (LRS) and Short Range Scan (SRS). The radar is no longer ground stabilized, pitch angle affects your radar's performance. In addition, target aspect and variable ASE circles make "locking-up" targets somewhat more difficult.

Target designation is now a multi-step process involving various new scan modes. These new radar modes are introduced depending upon the type of missile you have placed "in priority."

3) **Air-to-Ground Radar:** When the Air-to-Ground radar is placed in *Authentic Mode*, a number of targeting and mapping restrictions are instituted. Pilots are no longer free to designate any target area within the RBM display arc. A new feature, **Squint angle**, is introduced which prevents maps being generated at certain ranges, off-set angles and altitudes. A realistic time delay in generating maps from the RBM have also been added.

4) **TEWS:** This display has been totally revamped and no longer provides all the information you are accustomed to in *Standard Mode*. Read the TEWS section in detail before placing this option in *Authentic Mode*.

5) **Weapon Effectiveness:** The effectiveness of ordnance on various target types was ignored when in *Standard Mode*. When set to *Authentic Mode*, players must tailor their ordnance to the specific target being attacked. Targets are essentially either hardened or soft. They can be either point targets (such as bridges or chemical plants) or area targets (such as tank and troop concentrations).

Ordnance Types: Most Effective Against:

Mk. 82/ BSU-49 500 lbs. GP bombs: SAM sites, radar sites, small buildings, missile launchers, oil tanks, unfortified installations, port facilities, canal locks, truck depots, communications centers, aircraft hangers

Mk.84/ BSU-50 2000lb GP bombs: bunkers, towers, bridges, large buildings, port facilities, hardened aircraft hangars, hardened ammo dumps

Mk.20 Rockeye: vehicles (armored and unarmored)

GBU-10: bunkers, hardened aircraft hangars, bridges, fortified structures

GBU-12: Small buildings, SAM radar sites, oil platforms, pumping stations, vehicles

GBU-15: bunkers, all hardened targets, bridges, fortified structures, large buildings

CBU-87: vehicles (armored and unarmored), tents, jungle HQs, ammo dumps, triple-A sites, SAM sites, depots, terrorist camps

CBU-89: vehicles (armored and unarmored), tents, depots, fuel storage tanks

AGM-65D Maverick: vehicles (armored and unarmored), fuel storage tanks, mobile SAMs, small ships, communications centers, tents

AGM-84A HARPOON: All naval targets (ships, tankers, missile boats, etc.)

AGM-84E SLAM: bunkers, hardened aircraft hangars, oil platforms, bridges, fortified structures, large buildings

AGM-88A HARM: All active radar sites (SAMs, GCIs, etc.)

Durandal: Airfield runways (paved surface)

6) **MPD/MPCD Color:** In *Authentic Mode*, colorized screens appear only on the three MPCDs. Note that not all display modes are colorized. If a display mode is not in color to begin with, it will not be colorized even if viewed on a MPCD.

7) **Targeting FLIR:** The Targeting FLIR has only a 180 degree forward field of vision in *Authentic Mode*. In addition, the FLIR may only be viewed in monochrome green (InfraRed).

8) **Tactical Situation Display:** Enemy aircraft and ground installations are not displayed on the TSD while in *Authentic Mode*. Terrain features are still displayed. Pilots will have to rely on the TEWS display to evaluate threats to the aircraft.

9) **Training Mode:** The Training mode option is initially turned Off when in *Authentic Mode*. However, it may be turned On at any time. As in *Standard Mode*, you receive no points for a mission if Training mode was activated.

10) **No Crash:** The No Crash option is turned Off. You now have to abide by a rule common to all pilots and aircraft: avoid contact with the ground at all times. If your aircraft hits the ground it is destroyed. If you are still in it when it hits, consider your career ended.

11) **Landings:** The wide margin of error given you in *Standard Mode* is now gone. Your descent rate and pitch attitude when landing are crucial considerations for safe landings. In addition, you must stay on the paved portion of the runway while landing and taxiing.

12) **Damage:** In *Authentic Mode*, damage is assessed more realistically. Now, one hit from a radar-guided missile with its large warhead is sufficient to cause multiple system damage and possibly shoot down your aircraft.

Any hits from ground fire and heat seeking missiles do significant damage but not always enough to destroy your aircraft. One hit is enough to possibly end a career, so use the TEWS and ECM wisely. Keep from being hit and this section shouldn't concern you.

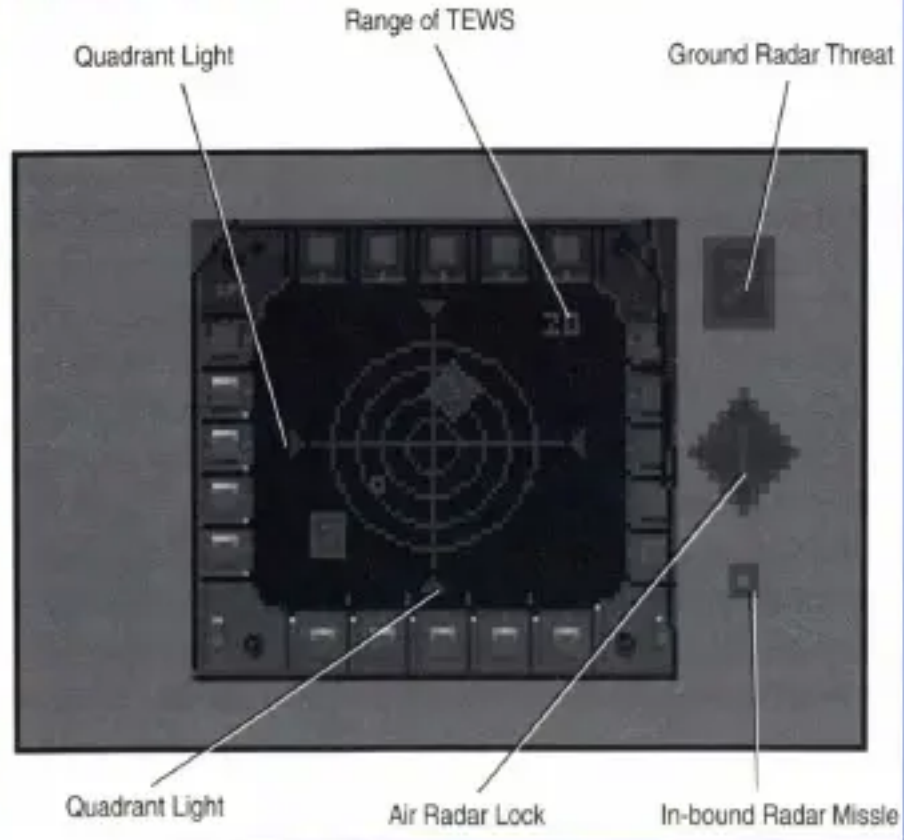
AUTHENTIC MODE TACTICAL ELECTRONIC WARFARE SYSTEM (TEWS)

You have two principal means of detecting enemy aircraft and avoiding being surprised: radar and the **Tactical Electronic Warfare System (TEWS)**. Of the two methods, TEWS is perhaps more useful because it is an undetectable passive system which does not alert the enemy to your presence.

The TEWS display screen appears on an MPD/MPCD as a series of four concentric circles centered on a pair of horizontal and vertical lines. At the tips of each of these axis lines are located small triangles. These triangles are known as Quadrant lights.

Your aircraft is centered at the intersection of the *x* and *y*-axis lines, i.e. in the middle of the display. It is oriented so that the top of the display always represents 12 o'clock (in front of your aircraft). The bottom of the display is your aircraft's 6 o'clock position (the rear of your aircraft).

AUTHENTIC MODE TEWS



Unlike the Standard Mode TEWS, there is no icon representing your aircraft. Note that the position of your aircraft on the display is different from the radar displays. On those displays your aircraft is centered along the bottom edge.

The range of your TEWS is variable. You may select ranges of either 10, 20, and 40 nautical miles. The current range selection is shown in the upper right corner of the display. To change the range setting, place the MPD/MPCD "in command" by pressing the *alt Key* plus the display number. You may now press ***Zoom View In* (z Key)** or ***Zoom View Out* (x Key)** to toggle between range settings.

Regardless of the range setting, the distance between each of the circles is equal to one-quarter of the maximum display you have selected. For example, if your TEWS is set to 40 nm, the circles are located at 10, 20, 30, and 40 nautical miles. At 20 nautical miles, the circles represent radii of 5, 10, 15, and 20 nm.

Even though the maximum TEWS display range is limited to 40 nm, it can detect enemy radar searches out to 80 nautical miles. Located at the tips of each of the axis lines are Quadrant lights. Quadrant lights indicate the presence of an enemy radar searching for your aircraft. Once a radar sweep is detected, the Quadrant lights are turned on accordingly. You also receive an audio "beep" warning.

Not only do the Quadrant lights indicate the presence of an enemy radar, they also give a rough estimate of the radar's bearing from your aircraft. For example, an enemy radar is detected off to the left of you. This causes the Quadrant light in the 9 o'clock position to illuminate. The enemy radar falls within a 90 degree arc centering on the left side of your aircraft. If your aircraft was heading directly north (a heading of 360 °), the quadrant arc would extend from 225 ° to 315 °.

THE TEWS DISPLAY IN OPERATION

The TEWS behaves differently according to the disposition of the enemy radar: **Searching**, **Tracking**, and "**Locked-launching.**"

When an enemy ground-based radar search sweep is detected, the appropriate TEWS Quadrant light illuminates. You also receive an audio alert cue.

When an enemy ground-based radar is *Tracking* your aircraft, a square icon appears on the TEWS at the appropriate range and bearing. You also receive an audio alert cue.

When an enemy ground-based radar has "*Locked-On*" to your aircraft and has launched a SAM, its icon begins flashing. The missile appears as a smaller square icon over top of the flashing icon. The [**S**] Cockpit instrument light also illuminates and an audio warning is received.

Enemy aircraft radars appear on the TEWS only after they have "*Locked-On*" to your aircraft. A diamond-shaped icon is placed at the appropriate range and bearing. The [**AI**] Cockpit instrument light also illuminates. Count on a missile being fired when you see the radar icon even though it does not flash when a missile is launched.

TEWS DISPLAY ICONS

The TEWS has a capability of displaying up to ten aircraft and ground-based radar icons simultaneously. If there are more than ten radars "locked" onto your aircraft, the TEWS drops the additional detections according to a specific order of precedence. The order of priority is 1) SAM launches, 2) Aircraft with radar "lock," 3) Triple-A batteries with radar "lock," 4) SAM batteries with radar "lock." Lower priority radars are dropped from the TEWS display if a radar with a higher priority is detected.

Airborne radars appear on the display as **diamond-shaped** symbols. Enemy ground-based radars appear as **square-shaped** symbols. Inside each of these icons is a number from 1-9 which signifies the type of radar emissions being detected by the TEWS. The numbers inside the icons correspond to the type of radars listed below:

Ground-based Radar Indicators (square icons)

[1] Continuous wave Long-range SAM radars
SA-2, SA-3

[2] Pulse-Doppler Long-range SAM radars
SA-5, HAWK

[3] Continuous wave Short-range SAM radars
SA-6

[4] Pulse-Doppler Short-range SAM radars
SA-8, Skyguard, Roland

[8] AAA Acquisition and Tracking radar
Triple-A batteries

[9] Long-range Search radars
Ground Control Intercept (GCI) Stations

Aircraft Radar Indicators (diamond icons)

[1] Pulse-Doppler Multi-target Search and Track radar
F-15C/E, F-14D, F/A-18, MiG-29

[2] Pulse-Doppler Single-target Search and Track radar
F-16, F-4G, F-111

[3] Multi-mode Search and Track radar
MiG-23, MiG-25, Kfir, Mirage III/5, Mirage F-1

[4] Single-mode Search and Track radar
MiG-21, Jian F-7, Su-20/22, F-5E

[5] Range-only radar
MiG-19, F-6, MiG-27, Su-7, Su-24

[9] Airborne Early Warning radar (AWACS)
E-3 Sentry, Il-76 Adnan

MISSILE DETECTION AND WARNINGS

In addition to detecting air and ground-based radars, the TEWS also has the capability of detecting radar-guided SAMs and air-to-air radar missiles. Radar missiles, both ground and air launched, appear as smaller squares which are not numbered. If detected, you receive audio/visual warnings when they are launched.

Heat-seeking missiles do not appear on the TEWS because no radar emissions are used to track the target. The [**AI**] cockpit caution light does illuminate, however, and an audio warning sounds when a heat-seeking missile is launched.

If a detected SAM installation launches a radar-guided missile, its icon begins flashing on the display. You can see the missile icon leave the flashing SAM installation and begin heading toward your aircraft. The [**S**] Cockpit instrument light also illuminates. This should give you plenty of time to deploy counter-measures or maneuver to defeat it. While the TEWS is merely a backup system for detecting enemy aircraft, it is absolutely essential in dealing with the SAM threat.

When an aircraft with a "lock" fires a missile, its icon does not flash. You do receive audio warnings, however. In addition, the [**AI**] Cockpit instrument light illuminates. Again, a radar-guided missile appears on the TEWS display as a small unnumbered square.

Any time you see a diamond symbol on your TEWS, count on a missile coming your way. (Just think how quickly you fire a missile once you achieve a "lock." Enemy pilots are just as eager to shoot at you). The best way to defeat air-to-air missiles is to prevent them from ever being fired in the first place.

Another aspect of the TEWS suite is the radar jammer which is tied into the detection equipment. The internal jammer is initially turned on by pressing ***Jammer Active*** **(j Key)**. This key puts the Jammer in a "standby" mode. Once in this standby mode, it automatically counters any radar emissions directed at the aircraft. **Do not** press the key each time a radar "lock" is detected, the Jammer functions independently. When the Jammer is functioning the words "**Jammer Active**" appear along the bottom of the TEWS.

Jane's Defense Group

One drawback to the Jammer is its effect on your EMIS state. With the Jammer functioning, the emissions are detectable. In this respect using the Jammer is a trade-off. It may save your life and prevent a missile from being fired but everyone is now able to spot you. The EMIS light illuminates on the console indicating the Jammer is functioning.

AUTHENTIC MODE AIR-TO-AIR COMBAT

Authentic Mode is a more accurate simulation of the actual AN/APG-70 radar system. Here, you are required to control the various settings and aspects of the radar system. It is the most complex mode and requires a high degree of Situational Awareness on the part of the operator. Because of its inherent complexity, it is recommended that the *Standard Mode* settings be mastered first before trying this more advanced mode.

AIR-TO-AIR RADAR

The F-15E is equipped with the **AN/APG-70** X-band pulse-Doppler radar system. This radar represents a substantial improvement over its predecessor, the AN/APG-63 system. The AN/APG-63 system is still utilized by the majority of F-15C/D models, but they are scheduled to be upgraded in the near future.

By comparison, the AN/APG-70 has a much greater RF band-width and a larger look-down detection range. It utilizes VLSI technology (Very Large Scale Integration) with chips containing 10,000 or more logic gates. It also is able to operate with a reduced number of system components.

In the *Authentic Mode* Air-to-Air role, the radar has two search modes: **Long-Range-While-Scan** (LRS) with interleaved Pulse Repetition Frequencies waveforms (PRF) and **Short-Range-While-Scan** (SRS) with full medium PRF. The radar also has **Track-While-Scan** (TWS), **Single-Target-Track** (STT), and two **Auto Target Acquisition** (AUTO) modes.

In the air-to-ground role, the synthetic aperture radar capability can produce high-resolution (HRM) or real-beam (RBM) mapping down to a highly detailed scale of 0.67 nm. There is also precision velocity updating and air-to-ground ranging.

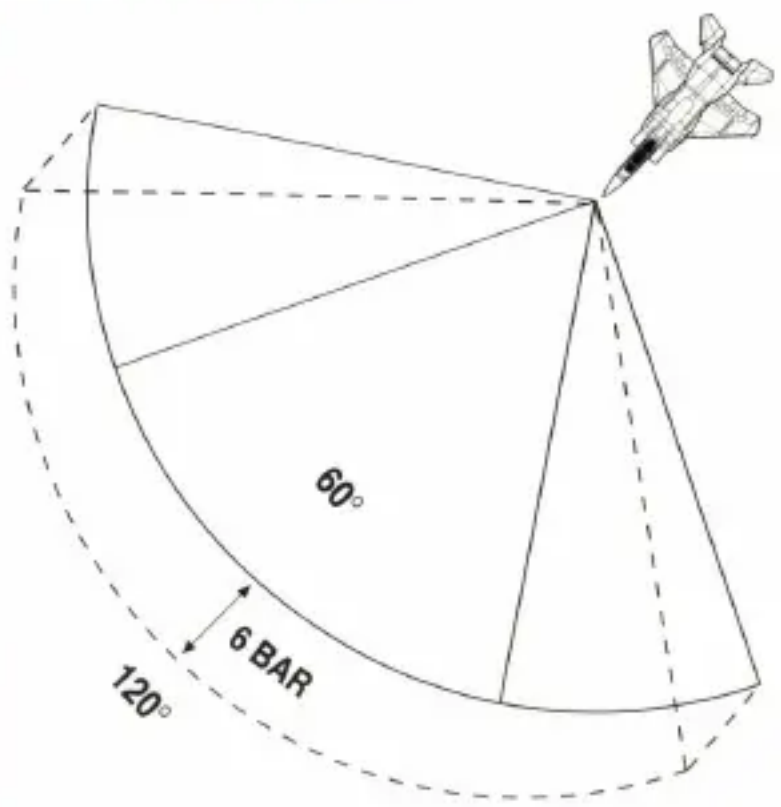
The HUD is integrated into the various air-to-air and air-to-ground radar modes, and automatically switches into the corresponding Master Mode.

AIR-TO-AIR BASIC CONCEPTS

A radar beam has two primary components. The first, scan width or **Azimuth**, is automatically set by the radar system at either 60° or 120° depending on the selected radar mode. The radar scans only within the indicated azimuth. Bogies outside of the indicated azimuth to the left or right do not appear on the radar screen. The two bright pips along the x-axis (bottom horizontal line) indicate the current azimuth of the radar beam. The caret oscillating along the x-axis indicates the current azimuth position of the radar beam.

The second component, scan depth or **Bars**, is fixed at 6 bars. A bar is a single scan band that the radar follows across the sky bounded by the azimuth setting. With 1 bar, the beam would scan left to right, then right to left along the same scan line. With 6 bars, the beam scans left to right, drops down the equivalent of 1° at 80 nm range, scans right to left, drops down scans left to right, and so on.

AZIMUTH AND BARS SCAN



When it reaches the bottom left corner of the 6th bar, it starts over at the left corner of the first scan line. As a result, 6 bars covers a greater depth of sky than with 4 bars, 2 bars, or obviously, 1 bar. Bogies outside of 6 bars, either above or below do not appear on the radar screen.

This fixed 6 bars setting maximizes beam coverage, and is the most popular setting on the actual radar. The caret oscillating along the y-axis (left vertical line) indicates the current bar position of the radar beam.

A third important aspect now comes into play: **Antenna Elevation**. While the antenna is in the 6 bars setting, you are able to aim it higher or lower into the open sky. You can scan the entire sky without having to change your altitude. The two bright pips along the y-axis indicate the current altitude coverage of the radar at the acquisition symbol; this information is also presented numerically.

Your F-15E is centered along the **bottom** of the radar display looking up or ahead. Aircraft (friendly and enemy) always appear on the grid ahead of your point of view (in your 12 o' clock position). The display itself is a 4 by 4 square grid divided into 30° increments along the x-axis, and and four increments of nautical miles (nm) along the y-axis.

RADAR STATE

It may seem too obvious of a point, but still one worth mentioning. The radar system must be fully active before any of the modes to become operational. To activate the radar, simply toggle ***Radar Activate*** **(r Key)**. Toggling this key alternates the radar between its active state and SNIFF mode.

Technically speaking, the radar system is never off during flight, but is placed into an inactive or standby mode called **SNIFF**. The radar antenna continues to scan along its designated path, but does not emit any energy. When the radar system is in SNIFF mode, the radar screen is blank and the word "SNIFF" is displayed. The current radar mode is still displayed and is adjustable while the radar is in SNIFF mode.

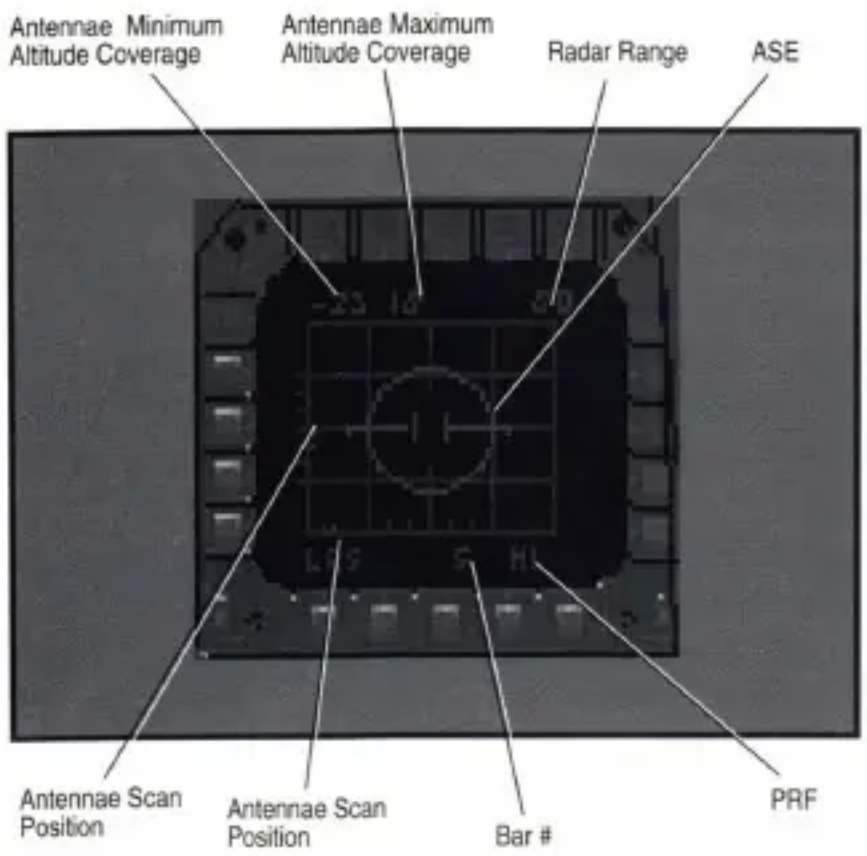
When the radar system is active, the (EMIS) indicator illuminates indicating that your F-15E is emitting radar energy. The emission of radar energy gives enemy search systems an added advantage to locating your F-15E. Any type of energy emission is like a bright beacon in the sky. Your radar system should be utilized with this in mind. Indiscriminate use could make the difference between success and failure.

LONG RANGE SCAN (LRS)

This is the basic air-to-air radar search mode and default setting when selecting the Air-to-Air Master Mode. The current mode is always indicated in the lower left corner.

The LRS mode is heading stabilized with the radar antenna always pointing in the direction the aircraft is heading. It has an azimuth of 120° and a default range of 80 nm. The bright pips along the x-axis are at the extreme edges, or 60° per side equalling 120°. The value in the upper right corner is the current range setting; 80 nm. Therefore, the individual horizontal breaks indicate ranges from 0 (your aircraft's position at the bottom), to 20, 40, 60, and 80 nm from your aircraft.

LONG RANGE SCAN (LRS) RADAR



As was first mentioned in the initial description of the AN/APG-70 radar system, the LRS mode features interleaved **PRF**. This means that the LRS mode alternates between high and medium PRF. This may seem a bit cosmic (fighter-speak for a sophisticated system), but it is actually quite simple.

The radar uses pulsed beams rather than a continuous radar beam to search for enemy targets. High PRF pulses are necessary to detect targets at long range, in respect to velocity, but are not suitable for measuring range because there is not enough time to correlate the data before the next pulse fires. Medium PRF pulses do not have the power to detect long range targets, but are an accurate measurement of range. They can distinguish between targets and false returns generated by ground clutter.

The current PRF status displays in the lower right hand corner. The value indicates the bar currently scanned; "HI" indicates high PRF and "MED" indicates medium PRF. Notice that the radar alternates between HI and MED PRF as it moves down the bars and when it cycles back to the beginning of the 1st bar. In this way, an individual bar is not continually scanned with the same PRF pulse.

HUD SYMBOLOGY

The HUD does not display any special data when the radar is in LRS mode.

RADAR RANGE (AIR-TO-AIR MODES)

The radar range is changed by pressing ***Radar Range*** **(home key)** to toggle the range. The range can be set to 10, 20, 40 or 80 nm, although anything under 40 nm in LRS mode is more of a handicap than an asset. As with 80 nm, the individual horizontal breaks still represent 1/4 of the maximum range setting. For example, with a 20 nm setting, the individual horizontal breaks indicate ranges from your aircraft's position at the bottom, (0 nm), to 5, 10, 15, and 20 nm from your F-15E.

ANTENNA ALTITUDE

The antenna altitude coverage can be raised 5° by pressing ***Antenna Up*** **(page up key)**, or lowered 5° by pressing ***Antenna Down*** **(page down key)**.

The current antenna altitude coverage is displayed graphically by the two bright pips on the y-axis, and numerically by the two values in the upper left corner. The first value is the lower altitude limit, in thousands of feet, and the second value is the upper altitude limit, also in thousands of feet. For example, if the altitude indicates "18 35", the radar is scanning between 18,000 and 35,000 feet in regard to the position of the ACQ Symbol (more on that later). Any potential targets flying below 18,000 feet or above 35,000 feet do not appear on the radar.

As you climb or dive the F-15E, the altitude indicators change based upon the new attitude of the plane. If you dive, the antenna is pointing more toward the ground; the maximum altitude coverage is now less. The reverse is true if you climb.

BOGIES & BANDITS

Bogies appear as bright green boxes on the radar display. In LRS mode, no altitude information is given, only range indications. Do not let the relative position of the green boxes disorient you. Just keep in mind that they are out in front of your F-15E. They may be above or below your current altitude, but at this point you have determined the most important piece of information, that a potential threat exists.

TARGET AGING

All of the radar modes, including LRS, age scanned targets. As the beam scans away from the target, it maintains its last known position by displaying a subdued green box. When the target is again scanned, its new position immediately updates on the radar and the aged box is erased.

Target aging can be utilized as a rudimentary altitude scale. If the bar scan caret is at the top of the scale, and a target quickly ages, you can interpret this to mean that it is near the indicated maximum altitude coverage limit. The reverse is also true of the lower end of the bar scan.

ACQUISITION SYMBOL

After all that, there is still one last piece of data to digest, the Acquisition Symbol. The ACQ Symbol (pronounced "Ax"), looks like two parallel vertical lines or captain's bars. It is located in the center of the radar display bracketed by the horizon line. Think of the ACQ Symbol as a pointing device that is used to direct the radar to look in a certain direction or to designate a target.

The ACQ Symbol can be used to determine the antenna coverage, in thousands of feet, at any particular range. Use the *Controller* to move the "captain's bars" cursor into the radar screen. It changes into the ACQ Symbol. As you move the ACQ Symbol up and down the screen, notice that the bright pips along the y-axis change along with the values in the upper left corner.

For example, if you sit on the runway with your LRS radar mode active and place the ACQ Symbol on the 60 nm range line, the values read "-35 35." This indicates that at 60 nm, the radar is scanning from -35,000 feet to 35,000 feet. While a negative range coverage may seem some what strange, this is how the radar system is able to distinguish low flying aircraft.

TARGET DESIGNATION

Designation is the process of telling the radar system that you want to track a specific target or look at a specific point in space. Pressing ***Designate Target*** **(backspace key)** designates the radar on the closest target. Multiple presses of *Designate Target* toggles through all available targets from the closest to the furthest.

The preferred method of target designation is by using a mouse controller to move a cursor over the desired target. If you have a mouse, you can freely move the ACQ Symbol to designate an individual target or to use the ACQ Symbol to designate any point on the radar screen.

After designating a target, the radar automatically switches to **Track-While-Scan mode** (or Designated-Track-While-Scan: DTWS).

SHORT RANGE SCAN (SRS)

SRS is the secondary air-to-air radar search mode. It is activated by pressing ***LRS/SRS*** **(insert key)** when in LRS mode. Like LRS mode, SRS is heading stabilized. It has an azimuth of 60º by a default range of 40 nm. The range can be set to 10, 20 or 40 nm.

The HUD does not display any special data when the radar is in SRS mode. As opposed to LRS, SRS always scans in medium PRF; this is indicated in the lower right corner. Additionally, the bars in SRS are of greater depth than LRS, approximately 2.5º. Therefore, SRS covers a greater depth of sky. With its tighter, medium PRF 60º beam, SRS updates the radar screen much quicker, and is providing precise range information with every sweep. It should be the mode of choice once targets pass the 40 nm range line. Otherwise, the information displayed in SRS mode exactly matches LRS.

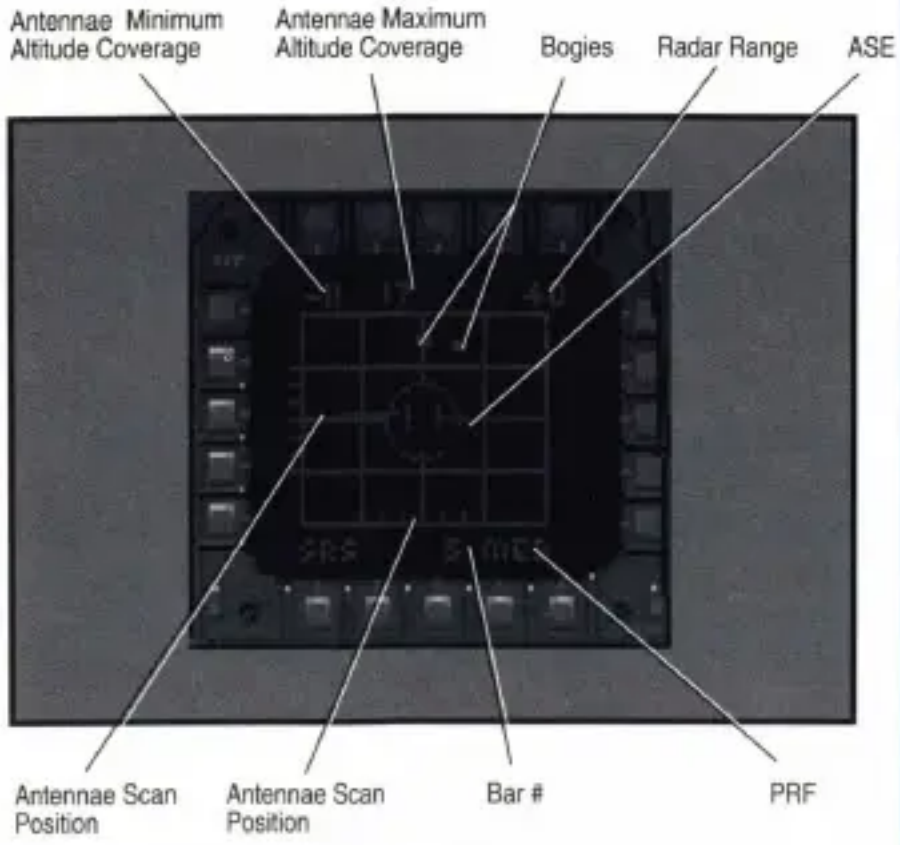
In SRS mode, the ACQ Symbol plays an additional role. Since SRS has a 60º azimuth, the ACQ Symbol can be used to aim the radar in the horizontal plane. Notice as you move the ACQ Symbol from side-to-side that the two bright pips along the x-axis align their position with the position of the ACQ Symbol. This powerful feature can be very useful when potential threats start to cut down the range. You are able to maintain them in your radar beam without having to change the heading of your F-15E.

As with LRS, designating the ACQ Symbol switches the radar into Track-While-Scan mode.

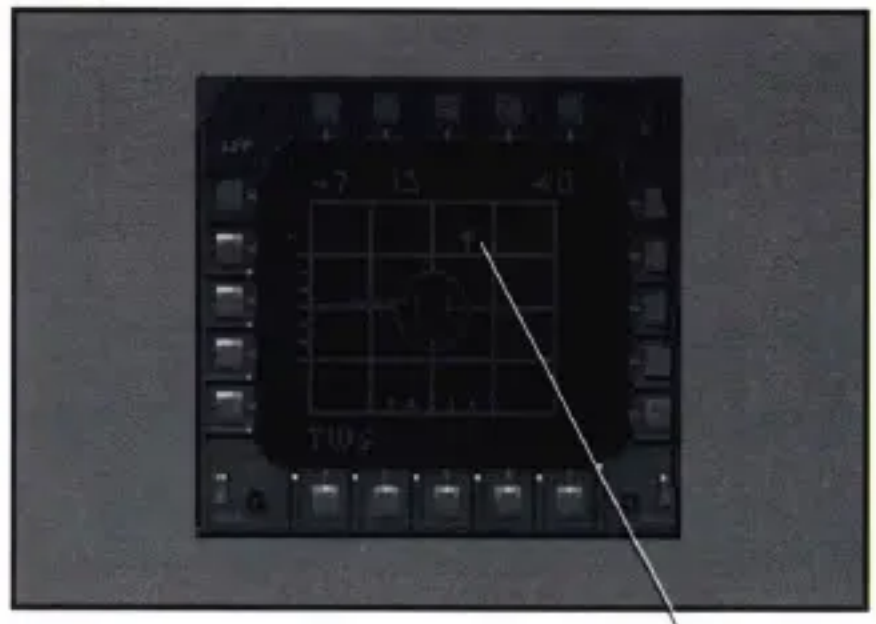
TRACK WHILE SCAN (TWS)

TWS (pronounced "Twiz") is the primary target tracking mode and is activated by pressing ***TWS*** **(delete key)**, or by designating the ACQ Symbol in either LRS or SRS modes. TWS is actually two separate modes,

SHORT RANGE SCAN



TRACK-WHILE-SCAN



standard TWS and Designated-TWS (called DTWS or D-Twiz). If TWS/DTWS is activated by pressing *TWS* or by designating the ACQ Symbol in an open area on the radar screen, TWS mode is activated. If a target is designated (the target is called the Primary Designated Target or **PDT**), DTWS mode is activated.

TWS/DTWS is space-stabilized. It locks on to a specific target or a point in the sky. As you change the heading of your F-15E, the radar maintains this space stabilization. This is very useful in maintaining a designated or locked target while maneuvering your F-15E.

TWS/DTWS has an azimuth of 60º and defaults to the indicated range (10, 20, 30, 40, or 80 nm) when the mode is activated. If the radar is unable to maintain its designation, it reverts to the last active search mode.

HEADING VECTOR

The radar screen in TWS mode appears exactly the same as LRS/SRS with one important addition, the Heading Vector. This is a small line leading off from the target box. Contrary to what you may think, it is not a tail but a "lead line." It always points toward the direction of flight.

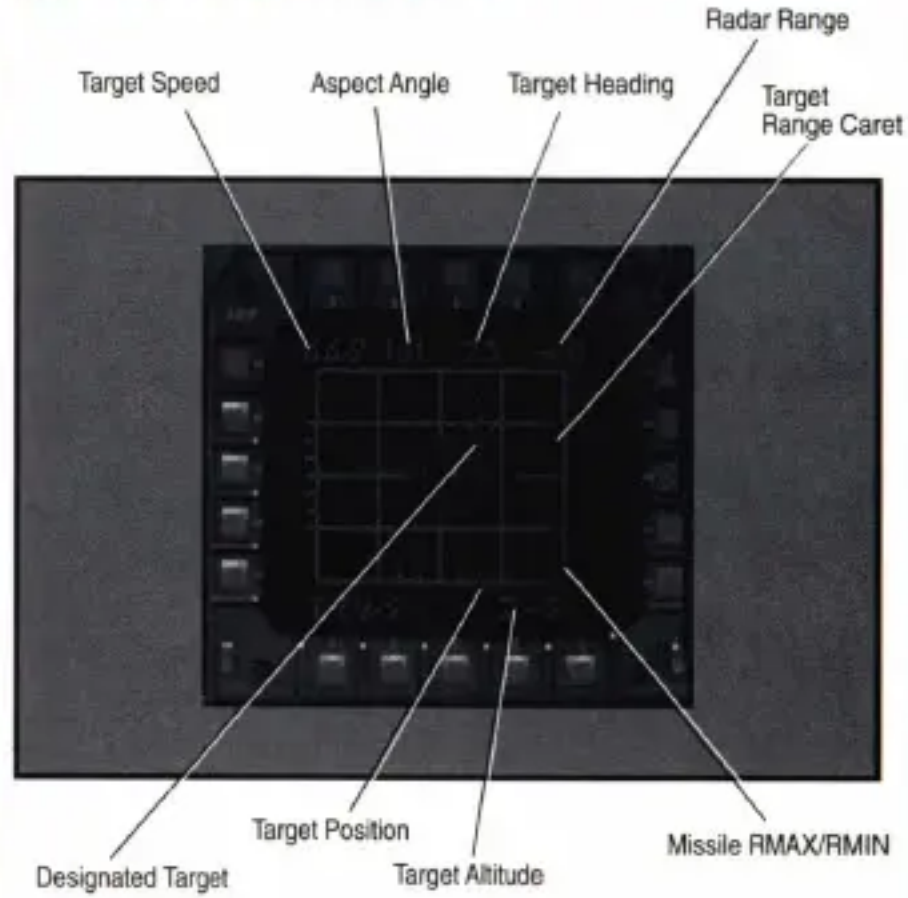
DESIGNATED-TRACK-WHILE-SCAN (DTWS)

When a target is designated, it changes from a box to an open diamond along with the Heading Vector. The information displayed on the radar switches from general radar data to target specific data. DTWS continually scans the designated target but also scans the area within the indicated azimuth and 6 bars. The designated target is the primary scan point, but other targets in the vicinity are also displayed along with their Heading Vectors. The azimuth and bar carets remain locked at the position of the designated target, however.

Moving across the top of radar display starting from the upper left corner; the first value is the designated target's current speed in knots, next is its aspect angle, followed by its heading, and finally, the indicated range of the display.

Across the bottom of the display in the lower left corner is the radar mode, and in the lower right corner is the target's current altitude in thousands and hundreds of feet (the first value is the thousands and the second value is the hundreds).

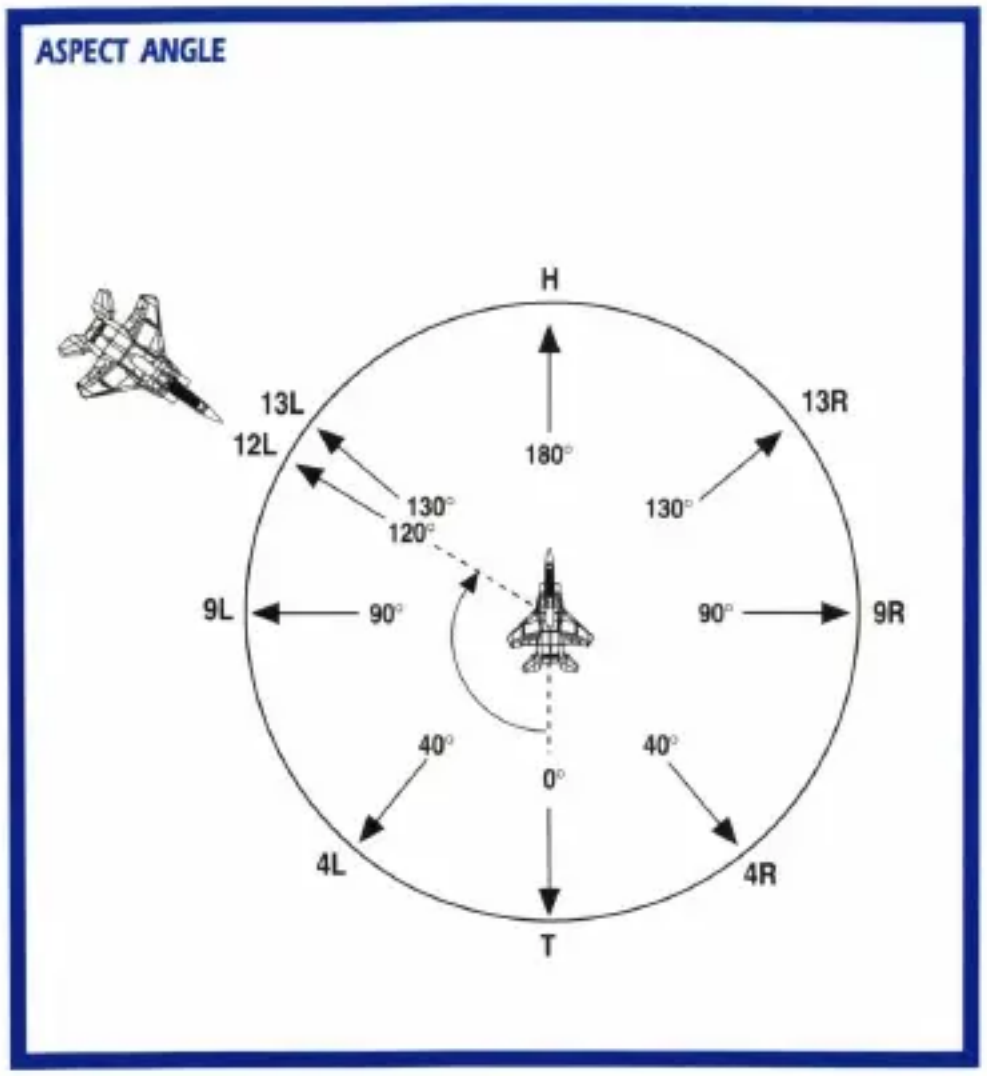
DESIGNATED-TRACK-WHILE-SCAN (DTWS)



When a target is designated and a missile is selected, a new set of prompts immediately appears on the radar display's right y-axis. There are two lines and a caret. The caret corresponds to the target's range. The upper line is the selected missile's maximum range; this is called **RMAX**. The lower line is the selected missile's minimum range; this is called **RMIN**. The target's range must be somewhere between RMAX and RMIN for a valid shot. This combined data element is called the **Radar Range Scale**.

ASPECT ANGLE

This is the horizontal angular difference between the tail of the target and the nose of your F-15E. The angle that these two points define is the Aspect Angle. The "L" or "R" means that your F-15E is looking at the left side or right side of the target.



The angle is defined as a single or double digit; the units digit is not significant and is dropped. For example, if the Aspect Angle is 12L (read as one-two-left), your F-15E is 120° off the target's tail on its left side.

If the Aspect Angle is increasing, your F-15E is passing to the front of the designated target; if it is decreasing, you are passing to its rear. If the Aspect Angle remains constant, your F-15E and the target are co-speed and co-heading. An Aspect Angle of "H" means your F-15E is flying directly toward the target on a collision course; "T" means your F-15E is directly in the target's six.

Aspect Angle is a very important consideration. You will come to see that Aspect Angle has a direct bearing on not only the quality of the shot but also a target's ability to take a shot at you.

RADAR AUTO-RANGING (DTWS)

DTWS has the added feature of automatic range scaling. If the PDT's range is approximately 2 nm less than a range boundary, the selected range automatically switches to the appropriate increment. For example, if DTWS is set at 40 nm, and as the PDT's range falls to 18 nm, the radar automatically switches into 20 nm range.

HUD SYMBOLOGY

In DTWS mode, the HUD mirrors part of the radar information. In the lower right corner of the HUD, a target's altitude, range and aspect angle are displayed from top to bottom.

LOCKING UP THE TARGET

When in DTWS mode, the PDT can be locked up at any time by pressing ***Target Lock*** **(l key)**. When a target is locked, its icon on the radar display changes from an open diamond to a solid diamond. If the selected weapon is either the gun, AIM-9M or AIM-7M, the radar automatically switches into **Single-Target-Track (STT) mode**; if AIM-120A is the selected weapon, the radar stays in DTWS mode.

In addition to the missile range data, two important cues now appear on the radar display; the **Allowable Steering Error** (ASE) and the **Steering Dot**. The **ASE** is located in the middle of the radar display, and depending on the location of the target, the Steering Dot is located in the vicinity of the ASE. The ASE is a dynamic element that changes its size, either becoming larger or smaller, depending on the target's Aspect Angle.

BREAK LOCK

Situations may arise when the locked target is no longer the primary threat. Another target of greater priority may have just appeared, and you need to switch locks. By pressing ***Break Lock*** **(k key)**, the lock is immediately dropped, and the radar automatically reverts to the last active mode.

This may seem somewhat confusing if the last active mode was AUTO and the locked target is the closest and is less than 10 nm away. In this case, the radar instantaneously drops the lock and restores the lock to the same target. This switch happens so quickly that you can not even recognize it. You may think that the Break Lock did not work, but this is not the case.

HUD SYMBOLOGY

The HUD mirrors ASE and Steering Dot cues just described along with a few of useful additions.

The Radar Range scale is located on the right side of the HUD. The information is displayed in the same manner as the radar display, plus it adds an additional factor, Closure Rate. Next to the target's range caret is a value. A positive value indicates the speed at which you are overtaking the target; a negative value is the speed the target is pulling away from you.

These two airspeeds are available elsewhere, but this way the system calculates the vectors and does the math. This information is useful to determine if you are chasing the target; if you are approaching head-on or approaching from the beam (Aspect Angles from six to one-one), it becomes significant to weapon selection and employment.

The HUD also adds another very useful reference cue, the **Target Designator Box (TD)**. The **TD** "boxes" the target as a visual reference to its location. The TD never totally leaves the HUD even as a target exits the HUD's field of view. The TD parks itself at the edge of the HUD. A line appears from the center of the ASE to the target's location. This line is appropriately called the **Target Locator Line**. Follow the line, the target is at the other end.

Finally, the **Gun Cross** appears directly below the the Heading Indicator when the selected weapon has missiles or rounds remaining.

LOCK-SHOOT LIGHTS

When a target is locked up, the two Lock-Shoot lights located on the aircraft's canopy brace illuminate. The lights begin flashing when you receive a Shoot cue.

SINGLE-TARGET-TRACK (STT)

The nature of certain missiles require the full support of the radar system in order to engage a target. AIM-9M and AIM-7M both engage targets from STT mode while AIM-120A engages targets from DTWS mode.

STT appears exactly the same as DTWS with one key exception; only one target ever appears on the radar display. No other aircraft, no matter how close to the target or your aircraft, appear on the radar display.

Do not get focused on this single target. It is imperative not to lock-up a target too soon. Stay in DTWS as long as possible so as to receive as much information about all of the targets.

AIR-TO-AIR COMBAT (MISSILE)

As stated earlier, the weapon must first be in range to take the shot. The shot must also be in constraints for the particular missile. This is not something you must calculate manually. The ASE and Steering Dot do this for you.

You might think that you would have to put the TD in the ASE. This is not necessary. All that is required is for the Steering Dot to be brought within the ASE circle. Remember that the ASE constantly changes with the target's Aspect Angle.

SHOOT CUE

Once the range and steering requirements are met a Shoot Cue appears on the lower center of the radar display and also flashes directly below the TD on the HUD. The Shoot Cue appears as a triangle for AIM-9M Sidewinder and AIM-7M Sparrow, or a six pointed star for AIM-120A AMRAAM.

If the Shoot Cue disappears before the shot is taken, you must wait for it to reappear. The shot is good only as long as the Shoot Cue is visible.

LOCK-SHOOT LIGHTS

When the Shoot Cue appears, the two Lock-Shoot lights located on the aircraft canopy braces will flash.

AIM-9M & AIM-120A (FIRE AND FORGET MISSILES)

The AIM-9A Sparrow and the AIM-120A AMRAAM are both fire and forget missiles. Once they are launched, your aircraft need not retain a radar lock-on in order for the missile to intercept the target. You may designate or lock another target or completely turn away from the target.

AIM-7M (MAINTAINING RADAR LOCK)

The AIM-7M Sparrow is a semi-active radar homing missile (SARH). It homes in on the reflected radar energy generated by your aircraft. After

launch, it is necessary that you maintain a radar lock-on (called "painting the target") until the missile intercepts the target. It **is not** necessary to maintain a Shoot Cue; just maintain the radar lock.

TIME TO INTERCEPT (TTI)

Once an AIM-120A AMRAAM or AIM-7M Sparrow missile is launched, the TTI data is displayed on the HUD as the final target entry in the lower right corner. The value is expressed in seconds to intercept the target. If the missile loses lock, "LOSING" displays in place of the seconds.

TTI is informational if an AIM-120A was launched, but is extremely useful if an AIM-7M was launched as the target must be continually illuminated by your radar for this missile to intercept the target.

BREAK X

Once the target range passes below RMIN, a large "X" appears in the center of the HUD and the center of the radar display. This symbol (called "Break X"), indicates that a shot is no longer possible, and the missile should not be launched. You must re-position your F-15E for a clear shot. If you take the shot, it will miss.

AIR-TO-AIR COMBAT (GUN)

The gun design of the F-15 series of aircraft overcame a limitation that long plagued the the F-4 Phantom II and earlier aircraft. With a gun mounted directly along the horizontal, you must actually fire more at the target's nose than at its mid-point. This is due to the natural drop in shells as gravity takes over. In tight-turning furballs you actually had to fire at a target just out of your point of view. Your F-15E's gun is canted up 2º from horizontal. Some ingenious engineer figured out that that was just enough to overcome the force of gravity at a range 3,000 feet or less.

Your F-15E is equipped with a **Lead Computing Optical Sight** (called **LCOS**, pronounced L-COS) for the on-board M61A1 20mm Gun. The LCOS uses your F-15E's motion and the radar range to estimate the target velocity and acceleration.

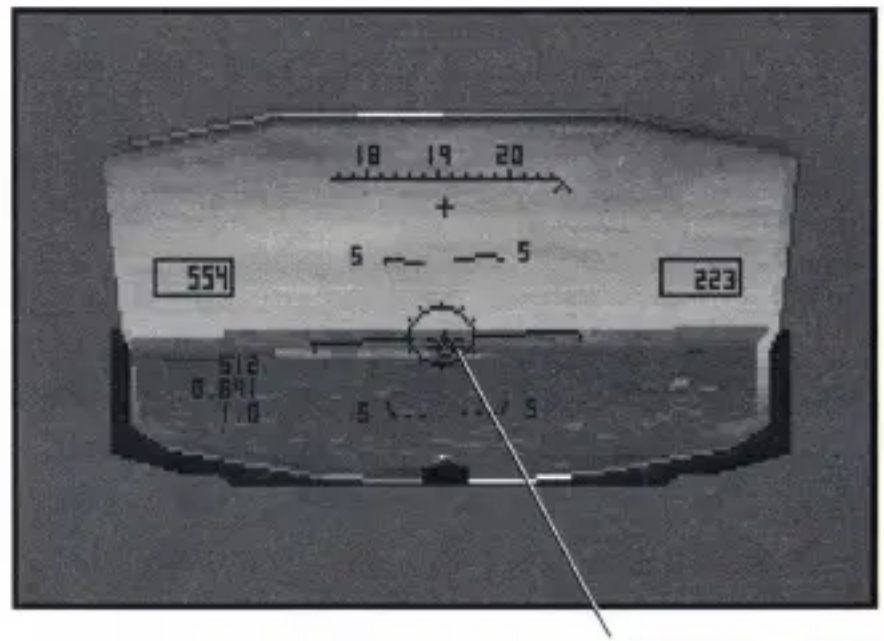
The gun has a maximum effective range of approximately 3,000 feet, or roughly 1/2 nm. The gun and gunsight are boresighted to the gun harmonization range of 2,250 feet; this is the optimum range. For all intents and purposes, the gun can fire a great deal further, but anything much beyond 3,000 feet and the dispersion of the shells makes any chance of hit unlikely.

When the gun is selected as the active weapon, the ASE is replaced by the gun sight reticle. Lacking a locked target, the reticle is positioned just above center line in the HUD. Remember the gun's 2º cant. With a locked target, the reticle floats in the HUD as it compensates for your F-15E's flight parameters. In reality, it can actually exit the HUD during non-constant high-g maneuvers.

The object is a simple one. Place the reticle on the target, attain proper range, and pull the trigger. Could it get any easier? Well, getting there takes some effort. The reticle must be stabilized on the target before a shot can be taken. The art of of stabilizing the reticle on the target is a matter of maintaining a g-level that is already attained. Quick, sharp violent maneuvers just throw the reticle around the HUD.

With a radar lock, the HUD displays the Radar Range Scale, but only displays target range and Aspect Angle in the lower right corner.

GUN HUD



AUTO TARGET ACQUISITION (AUTO)

AUTO mode is as close to a panic situation as you will ever want to see. It should only be used when no targets are active on your radar display and you suspect, just saw, or just had your target fly past your point of view. This way you get to the shooting without have to go through the entire sequence.

AUTO provides the widest beam coverage, but is limited to a maximum range of 10 nautical miles. AUTO mode is activated by pressing ***AUTO MODE*** **(end key)** or by selecting/pressing ***Guns*** **(1 key)** when in either search mode.

AUTO mode immediately locks up the first and nearest target, within 10 nm, that the radar detects. AUTO mode automatically switches to Single-Target-Track (STT) mode if Guns, AIM-9M or AIM-7M are the selected weapons. If the AIM-120A is the selected weapon, the radar switches to DTWS when a target is locked.

BORE SIGHT (BST)

Bore Sight is a special sub-mode of AUTO that is activated by a second press of ***AUTO MODE*** **(end key)**. When the radar is in Bore Sight mode (BST is displayed in the lower left corner), the beam is focused directly along the heading of the aircraft; a special BST beam pointer is displayed in the center of the HUD. Any target aircraft that ventures into or is placed within the beam pointer is immediately locked-up.

This mode is very useful to lock-up one of multiple targets at close range. Since AUTO mode automatically locks the closest target regardless of its orientation to your aircraft, BST enables you to select the target to lock.

IDENTIFICATION, FRIEND OR FOE (IFF)

Modern air combat seldom affords the opportunity to achieve a visual tally on a potential threat. IFF is a method utilized to determine if a bogey is a true bandit or a non-threat. Special electronic systems are used to "interrogate" a target to determine its nature.

Press ***IFF*** **(i key)** to interrogate a locked target **(IFF is only effective with a locked target)**. If friendly, a transponder in the locked aircraft automatically responds by "squawking" back with an audible tone. Additionally, the IFF light illuminates in the cockpit.

If you do not get a "squawk" the target icon immediately changes into an "X" symbol on the radar display indicating that the aircraft is hostile. Do not wait to see the whites of their eyes. Shoot first and ask questions later.

AUTHENTIC MODE

AIR-TO-GROUND COMBAT

PRIMARY AND SECONDARY TARGETS

Each mission requires you to attack a Primary and Secondary target. These two targets are generally related in that the same type of ordnance is used to destroy both. The order in which you attack these targets is unimportant and left up to you. Just remember, if you attack the Secondary target first, keep enough bombs on board to destroy your Primary.

Your prescribed flight path is displayed on the Tactical Situation Display (TSD). The first Sequence Point along the path is always the Primary Target. The second Sequence Point is the Secondary target.

AIR-TO-GROUND BASIC CONCEPTS

The AN/APG-70 radar system is able to discriminate potential ground targets on a high order and to utilize the synthetic aperture radar capability to create highly detailed maps of designated target areas. Complementary and support systems include the LANTIRN AN/AAQ-14 Targeting Pod with its high resolution FLIR and laser designator.

As is the case with the Air-to-Air Radar Modes, these modes most closely duplicate the actual functionality of the AN/APG-70 radar system when utilized in an air-to-ground role. This is not the mode to tackle initially; it is recommended that the radar be placed in *Standard Mode* first.

AIR-TO-GROUND RADAR

The primary air-to-ground radar modes are the Real Beam Map (RBM) and the High Resolution Patch Map (HRM). These two modes work in parallel to create highly detailed views of the forward area.

Azimuth, bars and antenna altitude are not an issue when in Air-to-Ground Master Mode. The radar system is ground stabilized and automatically determines the correct attitudes and settings for these aspects.

RADAR STATE

Technically speaking, the radar system is never off during flight, but is placed into an inactive or standby mode called **SNIFF**. The radar antenna continues to scan along its designated path, but does not emit any energy. When the radar system is in SNIFF mode, the radar screen is blank with the word "SNIFF" displayed.

The current mode is still displayed and is adjustable while the radar is in SNIFF mode. Press ***Radar Activate*** **(r key)** to activate the radar system. When the radar system is active, the EMIS indicator illuminates indicating that your F-15E is emitting radar energy.

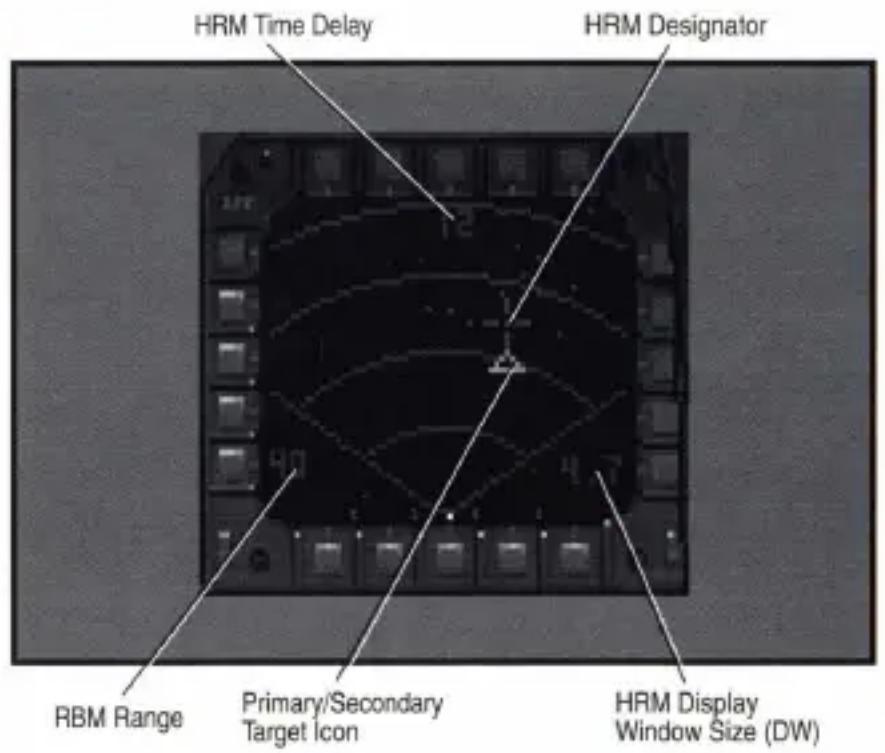
The emission of radar energy gives enemy search systems an added advantage to locating your aircraft. Any type of energy emission is like a bright beacon in the sky. Your radar system should be utilized with this in mind. Indiscriminate use could make the difference between success and failure.

REAL BEAM MAP (RBM)

The RBM mode is heading-stabilized. The radar antenna always points in the direction the F-15E is heading. It has a fixed azimuth of 100° and a maximum default range of 80 nm. The value in the lower left corner is the current range setting.

Your F-15E is positioned at the **bottom** of the radar display looking up or ahead. The display is divided into four incremental arcs representing nautical miles (nm). Terrain and objects appear on the grid ahead of your point of view (in your aircraft's 12 o' clock position). Therefore, if the default range is 80 nm, the individual arcs indicate ranges from 0 (your aircraft's position at the bottom), to 20, 40, 60, and 80 nm from your F-15E.

REAL BEAM MAP DISPLAY



RBM RADAR RANGE

The radar range can be changed by pressing *Radar Range* (home key) to toggle the range. The range can be set to 10, 20, 40 or 80 nautical miles.

The maximum range setting is dependent on the Above Ground Level (AGL) altitude of your F-15E, as indicated by the radar altimeter. If the AGL is 500 feet or less, the maximum possible range setting is 10 nm. If between 501 to 1000 feet; 20 nm, between 100 to 2000 feet; 40 nautical miles. If the altitude is above 2000 feet; 80 nautical miles. The RBM range defaults to these indicated maximums, and can not be set beyond these parameters as long as an AGL maximum limit exists.

As with 80 nm, the individual arcs still represent one quarter of the maximum range setting. For example, with a 20 nm setting, the individual arcs indicate ranges from 0 (your aircraft's position at the bottom), to 5, 10, 15, and 20 nm from your F-15E.

RBM TERRAIN & TARGETS

Terrain is displayed as shades of dark to light, with black as no terrain, or water, to brighter shades for higher elevations. Non-terrain objects appear as bright pips against the background terrain.

Depending on the range selected, these objects can appear as close concentrations or dispersed groupings. Objects on an 80 nm range RBM appear much closer together than the same objects on a 20 nm range RBM.

The RBM is continually updated as the radar beam passes across the scan area; terrain and objects are updated with each complete pass.

RBM SEQUENCE POINTS

These reference cues are placed on the RBM to assist in identifying important points on a mission. Your home airbase or tanker track, Primary and Secondary targets are all indicated on the RBM at the appropriate locations. The Primary and Secondary Targets are indicated as triangles. Your home airbase or tanker track is marked with a five-sided symbol shaped like the home plate in baseball.

RBM (DESIGNATING TARGETS)

Targets can be designated for area effect weapons such as Rockeye IIs, directly from the RBM. Other means should be employed for target designation when using point effect weapons such as AGM-65 Mavericks. Move the cursor by pressing ***Designate Target*** **(backspace key)** to the closest ground target. Multiple presses of this key toggles through all available targets from the closest to the furthest.

If you have a mouse controller, you can freely move the cursor to designate any target on the RBM screen or even a point on the ground. Pressing the **right mouse button** designates the target.

While targets can be designated directly from the RBM in this manner, it is most often utilized as a reference for "commanding" or making High Resolution Maps (HRM).

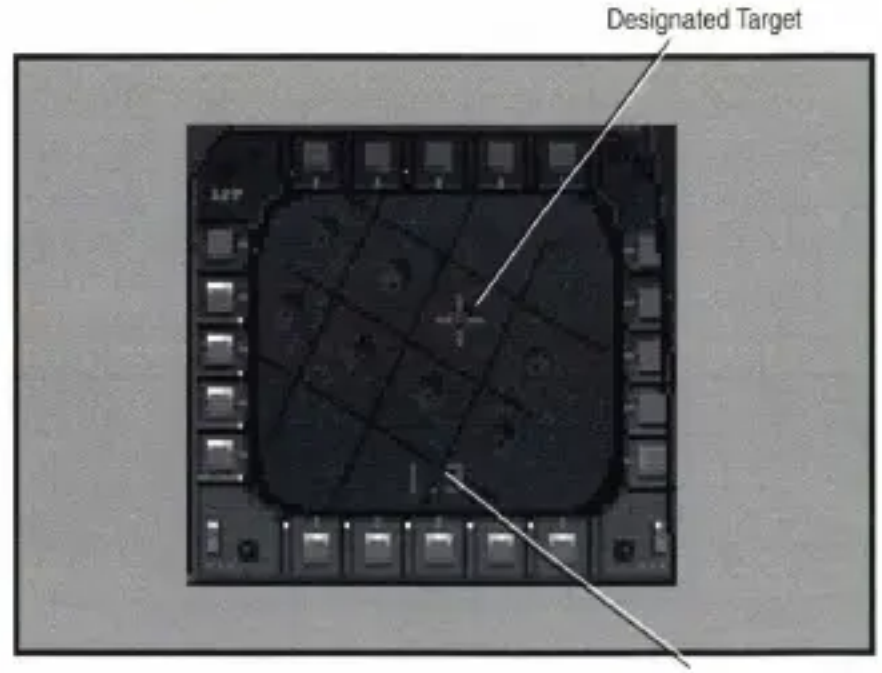
HIGH RESOLUTION MAP (HRM)

An HRM is created with the AN/APG-70's synthetic aperture radar capability. HRMs depict all the significant terrain features and objects captured within the beam; the radar Doppler shifts are converted into actual terrain and object features.

The system computer must go through literally millions of calculations before a map can be generated. As a result, HRMs are not generated instantaneously; there is a delay. As you move the cursor around the RBM screen the value displayed at the top of the RBM screen is the estimated delay for generating an HRM map at the cursor's current location. You can control this delay and the quality of the HRMs generated.

Static pulse Doppler radars, like ground-based radars, generate the strongest returns from objects moving across the radar's point of view. Objects moving directly toward or away from the radar generate the weakest return.

HIGH RESOLUTION MAP



With HRMs, your pulse Doppler AN/APG-70 radar is moving and the targets are stationary. Therefore, objects located at your sides or beam generate the strongest returns while objects directly ahead generate the weakest returns. In fact, you can not command an HRM directly ahead of your point of view. Offsetting your viewpoint from directly ahead is referred to as "**Squint Angle**"

HRMs commanded at the extreme boundaries of the RBM utilize max Squint, and are the quickest to generate and the most accurate. This concept may take some getting used to. Normal logic dictates that you look directly at an object or move directly toward a point. In this case, the indirect approach is the most advantageous.

HRMs can be commanded in seven increments: from a large, low-detail 40 nm map to, 20, 10, 4.7, 3.3, 1.3, and all the way down to a small, highly detailed 0.67 nm map. The value in the lower center of the RBM display is the current **Display Window Size (DW)** for the HRM. The **DW** is adjusted down by pressing ***Zoom View In*** **(z key)** and is adjusted up by pressing ***Zoom View Out*** **(x key).** Both of these adjustments require the screen to be "in command."

HRM MAP LIMITS

As is the case with the RBM, the HRM is also bound by certain limitations.

HRMs can not be commanded directly ahead of your flight path; the Doppler radar returns are just too weak. The cursor changes into an "X" within this off-limits area. If commanded from within this region, a "**BLIND ZONE**" error message is displayed for a few seconds.

DW	Min	Max
0.67 nm	3.0 nm	20 nm
1.3 nm	3.5 nm	40 nm
3.3 nm	4.5 nm	50 nm
4.7 nm	5.0 nm	80 nm
10 nm	11.0 nm	80 nm
20 nm	22.0 nm	80 nm
40 nm	44.0 nm	80 nm

HRMs can not be commanded outside of the 100° limit described by the RBM; the radar beam does not scan beyond the 100° limit. The cursor changes into an "X" within this off limits area. If commanded from within this region, a "**GIMBAL LIMIT**" error message is displayed for a few seconds.

HRMs are also bounded by minimum and maximum range limitations. The preceeding table indicates these minimums and maximums for each DW increment. The cursor changes into an "X" within these off limits areas. If commanded from within these regions, a "**DW RANGE LIMIT**" error message is displayed for a few seconds.

COMMANDING THE HRM

Commanding the HRM is the process of telling the radar system that you want to generate a map at a specific point on the ground. Move the cursor by pressing ***Designate Target*** **(backspace key)** to the closest ground target. Multiple presses of this key toggles through all available targets from the closest to the furthest.

Pressing ***Lock Target*** **(l key)** commands the map at the location of the cursor. If you have a mouse controller, you can freely move the cursor to command the HRM any target on the RBM screen or even a point on the ground. Pressing the **left mouse button** commands the HRM.

After commanding the HRM, its map screen is displayed after the delay lapses. The value in the lower center of the screen is the DW for the map. The value in the upper center is the time delay countdown for the HRM.

Additional high-detail HRMs can be commanded from an existing HRM. Increment the DW by pressing ***Zoom View In*** **(z key)** and press the ***Lock Target*** **(l key)**.

If you have a mouse controller, and the screen is in command, you can freely move the cursor to command the HRM at any legitimate point on the RBM screen. Pressing the **left mouse button** commands the new HRM.

HRM (SEQUENCE POINTS)

These reference cues are placed on the HRM to assist in identifying important points on a mission in the same manner as was described for the RBM.

HRM (DESIGNATING TARGETS)

Targets can be designated for all weapons directly from the HRM. Move the cursor by pressing ***Designate Target*** **(backspace key)** to the closest ground target. Multiple presses of this key toggles through all available targets on the map.

If you have a mouse controller, you can freely move the cursor to designate any target on the HRM map. Pressing the **right mouse button** designates the target.

OPTICAL GROUND TARGET DESIGNATION

While the majority of the ground targeting systems are optical in nature, they are so closely tied to the AN/APG-70's ground mapping systems that they are included here as part of the Air-to-Ground radar modes.

There are five methods of ground target designation. Two of these methods have already been covered in the preceding sections: RBM and HRM. The final three are the **LANTIRN Targeting FLIR**, the **HUD TD** (HUD Target Designator) and the **HUD Pipper**.

The LANTIRN Targeting FLIR is an all-weather, night/day system, while the HUD TD and HUD Pipper are optical, daylight only systems. They are point of view systems that utilize the old mark 1.0 eyeball method of designation; after all, you cannot designate what you cannot see.

Any one of these five methods can be utilized to designate a ground target or for that matter, any point on the ground. A target designated with one method can be changed or redesignated by the use of another method; the methods may be intermixed.

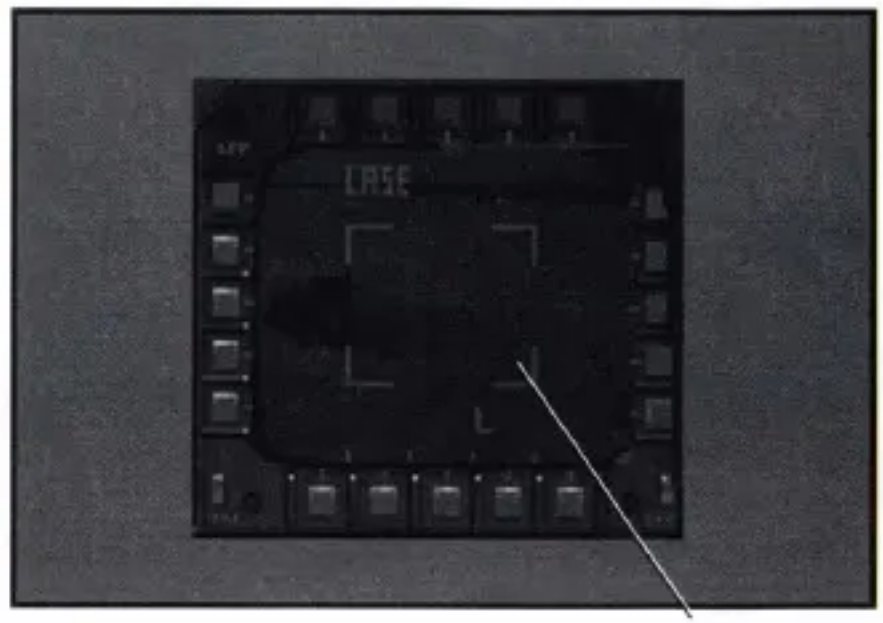
Care should be exercised. The flexibility of these systems are also their limitation. Since these techniques can designate any point on the ground, make sure that you have designated a legitimate target and not an open space by mistake.

AN/AAQ-14 LANTIRN TARGETING POD

The LANTIRN Targeting Pod, along with its sister the AN/AAQ-113 LANTIRN Navigation Pod, make the F-15E an awesome night strike-fighter.

Nestled under the left engine nacelle, the Targeting Pod combines a highly sensitive targeting FLIR (Forward Looking InfraRed) along with a laser ranger/designator, into a single compact package.

LANTIRN TARGETING POD,
FORWARD LOOKING INFRARED (FLIR)



Zoom-In Image

The targeting FLIR functions in conjunction with the RBM/HRM systems, or can be utilized totally independently for complete passive detection, for precise identification and targeting. The laser ranger/designator is utilized to "paint" targets detected via the RBM/HRM systems or targeting FLIR for the accurate delivery of laser guided bombs (GBU-10 and GBU-12).

LANTIRN TARGETING POD IMPLEMENTATION

Since the Targeting Pod utilizes passive systems, it is considered to be always active and on-line for immediate use whenever Air-to-Ground Master Mode is selected. As opposed to the AN/APG-70 Radar System, use of the Targeting Pod does not effect the F-15E's **EMIS** state.

The Targeting Pod has a maximum range of 10 nm. Targets closer to your F-15E are naturally easier to recognize and identify. The Targeting FLIR has a high degree of contrast and two fields of view (wide and narrow). Larger targets at extreme range should not be problem to identify.

The Targeting FLIR defaults to the wide field of view; this is indicated by a large "box" around the designated target; this is the field of view for narrow view. Narrow view is selected (the screen must be in command) by pressing ***Zoom View In*** **(z key)**. The view of the designated target zooms in when the Targeting FLIR is set to narrow view, but the field of view is naturally limited. Wide view is selected (the screen must be in command) by pressing ***Zoom View Out*** **(x key)**.

If the RBM/HRM systems are active, the Targeting Pod's viewpoint is automatically slaved to the RBM/HRM's point of view. When slaving its viewpoint to the RBM/HRM, targets designated via these systems are also automatically designated by the Targeting FLIR and centered in its point of view. The designated target can be changed by pressing ***Designate Target*** **(backspace key)**. Multiple presses of this key toggles through all available targets currently in the FLIR's field of view.

If you have a mouse controller, you can freely move the cursor to designate any target or point on the FLIR screen. Pressing the right mouse button designates the target.

HUD TD (GROUND TARGET DESIGNATION)

The HUD TD is only active if a mouse is available. When the cursor is positioned in the HUD, it changes into the TD symbol. To designate a target, position the TD over any point on the ground and press either mouse button. The target can be changed any number of times with this method. The TD may not be used to mark air targets.

HUD PIPPER (GROUND TARGET DESIGNATION)

This method is not unlike the air-to-air Bore Sight radar mode; the F-15E is basically utilized as a pointing device. In this case, the pipper is located at the point of the F-15E's velocity vector. At any time, pressing ***Designate Target*** **(backspace key)** designates the ground target currently under the pipper. A slightly nose down attitude is very useful when utilizing this method; it may not be used to mark air targets.

Note: The HUD Pipper is only functional if the RBM/HRM displays are not in command.

AIR-TO-GROUND DELIVERY MODES

All these air-to-ground designation methods lead to one specific end, the destruction of a target. There are three delivery modes for air-to-ground ordnance: CDIP, AUTO, and Guided Delivery. Laser delivery mode is actually a subset of AUTO and CDIP.

Some weapons utilize only one mode of delivery whereas other weapons can utilize different modes of delivery depending upon pilot preference or conditions. Where options exist, the delivery mode is selected by pressing ***Bomb Mode*** **(shft b key)**. The active delivery mode is displayed in the lower right corner of the HUD.

All modes, except CDIP, require a valid designated target before any weapon can be dropped or launched. You must get through that portion of the process before you can even think about sending any ground ordnance on its way.

CDIP MODE

CDIP (Continuously Displayed Impact Point: pronounced "See-dip") is a computer determined, manually initiated release mode for the delivery of all types of free-fall bombs including; Mk. 82, Mk. 84, BSU-49, BSU-50, Rockeye II, CBU-87, CBU-89, BLU-107/B Durandal, and GBU-10 and GBU-12 laser glide bombs.

CDIP is an optical delivery mode that constantly computes the impact point of the priority weapon. A weapon is placed "in priority" by pressing the desired ***Weapon Station*** **(4-8 key)**. CDIP automatically computes the impact point based on the selected weapon. When the weapon is released, you can be fairly assured of its impact point. It is the easiest mode to understand and master.

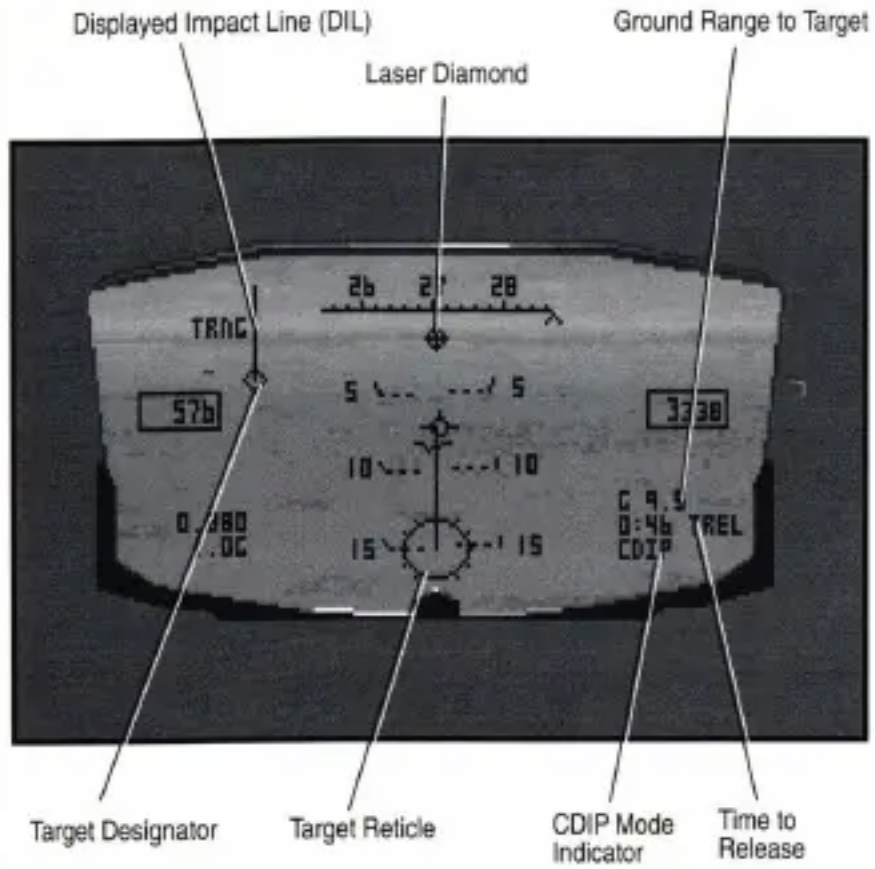
CDIP MODE TARGETING FLIR SYMBOLOGY

If a target is designated, it is marked by cross-hairs and centered in the FLIR display.

CDIP MODE HUD SYMBOLOGY

CDIP Mode is visually controlled and actuated through the HUD. Therefore, a number of cues are displayed on the HUD to aid in the delivery of the priority weapon.

CONTINUOUSLY-DISPLAYED IMPACT POINT (CDIP)
Bombing Mode



If a target has been designated (not required) it is marked by the **TD** symbol. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you toward it. (It works in the same manner as a Sequence Point caret).

In the lower right corner the "CDIP" mode indicator is displayed, along with the **Ground Range to Target (G)** and the **Time to Target (TTGT)** or **Time to Release (TREL)** if a target is designated. Both TTGT and TREL are expressed in minutes and seconds; the first value is minutes and the second value is seconds. If the designated target is behind your F-15E, TTGT is displayed, otherwise, TREL is displayed.

The Range to Target is measured somewhat differently than what you may be accustomed to. It is measured in only two dimensions. It is as if your F-15E was positioned flat on the ground and you were driving it, like a tank, to the target.

The current computed impact point is indicated by the Target Reticle, which is positioned at the bottom of the **Displayed Impact Line (DIL)**. Think of the DIL as a steering line; it is there to help you line-up the target.

CDIP MODE WEAPON DELIVERY

In CDIP Mode, the **Target Reticle** always marks the point of impact on the ground. Use the DIL to orient and stabilize your flight path; the DIL should be positioned to cut directly through the center of the target.

When the Target Reticle encircles the target (TREL should read zero with a designated target), press the ***Pickle Button*** **(spacebar key or Joystick button #2).** The weapon "in priority" is immediately released.

The fact that CDIP does not require a designated target allows you to immediately attack any target of opportunity. Just line up the shot and pickle the weapon.

CDIP LASER MODE

CDIP Laser Mode is utilized for the pinpoint delivery of GBU-10 and GBU-12 Laser Glide Bombs, and works hand-in-hand with the Targeting FLIR. It requires that you designate the target prior to launch.

CDIP Laser Mode is an all-weather delivery method that constantly computes the release time of the GBU-10s or GBU-12s based on the position of the designated target. These weapons are not powered, so their range is more limited than an AGM-64D Maverick at low altitude.

LASER DELIVERY MODE HUD SYMBOLOGY

Laser Delivery Mode can be actuated through the HUD. Therefore, a number of cues are displayed on the HUD to aid in the delivery of the priority weapon.

The designated target (required in this case) it is marked by the TD Symbol. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you to it.

In the lower right corner the "CDIP" mode indicator is displayed, along with the Ground Range to Target in nm (G) and the Time to Target (TTGT) or Time to Release (TREL). If the designated target is behind your F-15E, TTGT is displayed, otherwise, the TREL is displayed.

The designated target is marked by the TD Symbol. Additionally, the Laser Diamond is superimposed over the Gun Cross at the top of the HUD. This provides visual information as to the status of the laser.

LASER DELIVERY MODE TARGETING FLIR SYMBOLOGY

The designated target is marked by cross-hairs. When the designated target is within firing criteria, "LASE" appears at the top right side of the FLIR display along with a flashing "L" in the lower right corner.

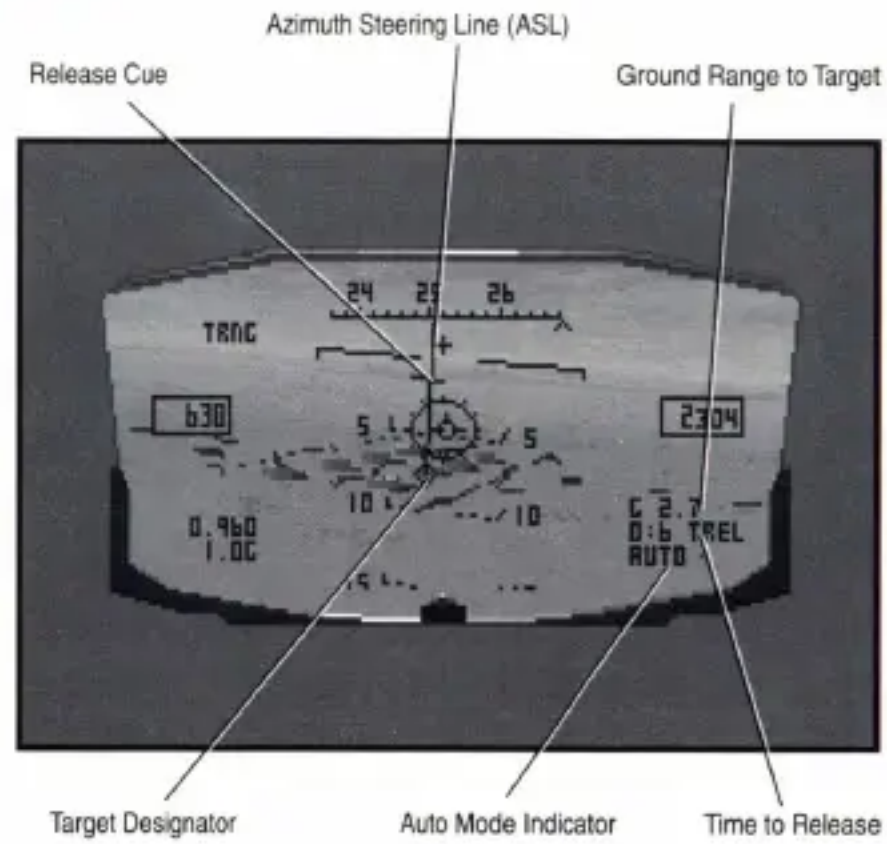
LASER MODE WEAPON DELIVERY

In Laser Delivery Mode, it is purely a matter of placing the designated target somewhere out in front of your F-15E. When the GBU-10 or GBU-12 is in range and the target is in the frontal arc of your F-15E, the HUD and Targeting FLIR both provide visible launch indicators.

When the target is in constraints, the Laser Diamond on the HUD starts to flash. The FLIR displays "LASE" in the upper right corner and a flashing "L" appears in the lower right corner. All of these cues indicate that the laser designator is currently painting the target; the active weapon may now be launched. It is not necessary to wait for TREL to reach zero before released the ordnance.

IMPORTANT: Your F-15E must continue to lase the target until the GBU-10 or GBU-12 impacts. GBU-10s and GBU-12s have a terminal velocity of approximately 400 kts. If your airspeed is faster than your bomb's airspeed, you could overfly the target before the bomb impacts. If you are not able to continually lase the target, the bomb goes ballistic and may or may not hit the target.

AUTO BOMBING MODE



AUTO MODE

AUTO Mode is a computed, automatic initiated release mode for the delivery of all types of free-fall bombs and laser glide bombs (see CDIP Mode for types). It constantly computes the release time of the priority weapon based on the position of the designated target.

AUTO Mode indicates a steering cue to line up the target and a cue when to pickle the weapon; it then automatically releases the weapon at the appropriate time. Bombing targets does not get much simpler than this.

AUTO MODE HUD SYMBOLOGY

AUTO Mode is controlled and actuated through the HUD. Therefore, a number of cues are displayed on the HUD to aid in the delivery of the priority weapon.

The designated target is marked by the **TD** symbol along with the **Azimuth Steering Line** (**ASL**) leading up from it. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you to it.

In the lower right corner, along with the "AUTO" mode indicator, are displayed the **Ground Range to Target (G)** and the **Time to Target (TTGT)** or **Time to Release (TREL)**. See CDIP for explanation of these indicators.

AUTO MODE TARGETING FLIR SYMBOLOGY

The designated target is marked by cross-hairs.

AUTO MODE WEAPON DELIVERY

In AUTO Mode, the Target Reticle always encircles the Velocity Vector. Use the ASL to orient and stabilize your flight path. The Target Reticle should be "driven" to cut directly through the center of the ASL.

At approximately 10 seconds prior to release, the **Release Cue** appears on the ASL above the TD symbol. This is a small horizontal bar that marches down toward the TD symbol. At or near the point the Release Cue appears, you should press and hold ***Pickle Button*** **(spacebar key)**. When TREL reaches zero, the priority weapon automatically releases.

AUTO LASER MODE

AUTO Laser Mode is utilized for the pinpoint delivery of GBU-10 and GBU-12 Laser Glide Bombs, and works hand-in-hand with the Targeting FLIR.

AUTO Laser Mode is an all-weather delivery method that constantly computes the release time of the GBU-10s or GBU-12s based on the position of the designated target. GBU-10s and GBU-12s are not powered weapons, so their range is more limited than a AGM-64D Maverick at low altitude.

LASER DELIVERY MODE HUD SYMBOLOGY

Laser Delivery Mode can be actuated through the HUD. Therefore, a number of cues are displayed on the HUD to aid in the delivery of the priority weapon.

The designated target (required in this case) it is marked by the TD Symbol. If the designated target is out of the HUD's field of view, a steering cue is displayed on the Heading Indicator that points you to it.

In the lower right corner the "AUTO" mode indicator is displayed, along with the Ground Range to Target in nm (G) and the Time to Target (TTGT) or Time to Release (TREL). If the designated target is behind your F-15E, TTGT is displayed, otherwise, TREL is displayed.

The designated target is marked by the TD Symbol. Additionally, the Laser Diamond is superimposed over the Gun Cross at the top of the HUD. This provides visual information as to the status of the laser.

GUIDED DELIVERY MODE

Guided Delivery Mode is a computed, automatic initiated release mode for the delivery of self-guiding weapons including: AGM-65D Maverick, GBU-15, AGM-84E SLAM, AGM-84A Harpoon, and AGM-88C HARM.

Guided is an all-weather bombing mode that hands off the designated target to the built-in, self-guiding logic systems of the priority weapon based on the position of the designated target.

Guided Mode indicates a cue when the priority weapon has acquired the designated target. Just press the pickle button and move on to bigger and better things. These fire-and-forget weapons guide themselves to the target.

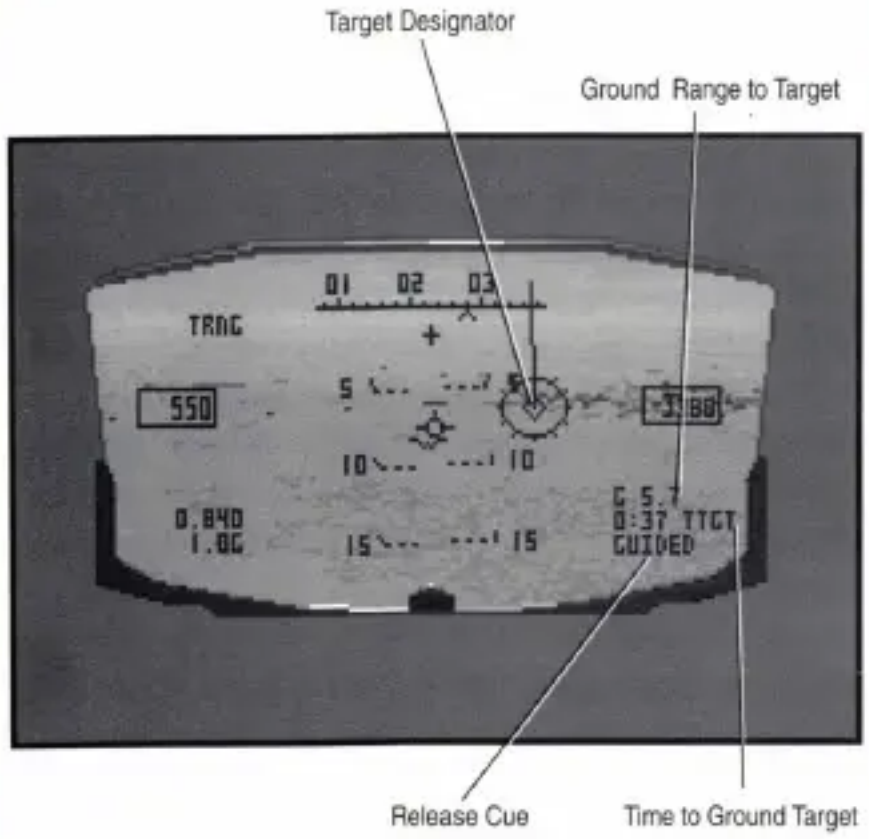
GUIDED MODE TARGETING FLIR SYMBOLOGY

The designated target is marked by cross-hairs.

GUIDED MODE HUD SYMBOLOGY

Guided Mode can be controlled and actuated through the HUD. Therefore, a couple of cues are displayed on the HUD to aid in the delivery of the priority weapon.

GUIDED DELIVERY MODE



The **Target Reticle** appears in the center of the HUD encircling the velocity vector. The designated target is marked by the **TD** symbol along with the **Azimuth Steering Line (ASL)** leading up from it. If the designated target is out of the HUD's field of view, a Target Steering Indicator is displayed on the Heading Indicator that points you to it.

In the lower right corner are displayed the **Ground Range to Target** (**G**) in nm and **Time to Target** (**TTGT**). See CDIP for explanation of these indicators.

GUIDED MODE WEAPON DELIVERY

In Guided Mode, success is purely a matter of bringing the active weapon into constraints. These weapons have a narrower field of view than your HUD; use that as an indicator. When the active weapon is in constraints, the HUD and Targeting FLIR both provide visible indicators.

When the target is in constraints, "GUIDED" is displayed in the lower right corner of the HUD and the Target Reticle snaps to encircle the TD symbol. The Targeting FLIR displays "IN RNG" (in range) along the right side of the display. Both of these cues indicate that the active weapon may now be launched.

There are two special case guided weapons: AGM-84A Harpoon and AGM-88C HARM.

The Harpoon is an anti-ship missile and therefore only guides on ship-type targets. Care should be taken to only launch a Harpoon against naval targets, i.e. ships. The AGM-88C HARM anti-radiation missile homes in on radar energy generated from a radar source. The HARM should only be designated against an enemy radar source. This can be accomplished from either the RBM/HRM or Targeting FLIR.

GUIDED DELIVERY LOCK-AFTER-LAUNCH

The GBU-15 and AGM-84E SLAM weapon systems have the added capability of locking onto a different target after launch. Since the image presented through the Targeting FLIR for GBU-15 and AGM-84E SLAM is the weapon's point of view as opposed to the F-15E's point of view, any target in the FLIR's field of view can be designated.

The normal procedure for designating targets through the Targeting FLIR is utilized. This can be changed any number of times prior to the weapon impacting the ground. This is an especially useful function with the AGM-84E SLAM due to its long range. This stand-off capability can be used to fly the missile into the general area of the target, and then to re-designate the actual or key target.

BREAK X

Releasing ordnance requires that your aircraft remain within certain flight parameters. For example, you would not want to release bombs while flying inverted or in a steep bank. If at any time you attempt to drop bombs from a prohibited flight attitude, you receive a Break X symbol.

When launching air-to-air missiles, a Break X symbol means that the target is too close. When releasing air-to-ground ordinance, the Break X means that your aircraft is in a flight attitude that prevents bombs from coming off their weapons stations cleanly. You will have to assume a different profile in order to release your ordnance.

AIRCRAFT DAMAGE

Until now all that has been discussed is what you are able to do to the enemy. This section deals with what the enemy can do to you.

On every mission you face a threefold threat: enemy aircraft, Surface-to-Air Missiles (SAMs) and ground fire. Luckily, you have counter measures available to defeat each of these threats. Even so, there are times when the enemy may catch you by surprise and score a hit.

There are sixteen different areas that can potentially be damaged during the course of mission. Some of these areas, such as hits to the Nav/ILS system, are not as critical as others. Hits which damage your Hydraulic system or engines should be viewed more seriously.

Damage to your aircraft is assessed according to the Difficulty Level you initially chose. It is also dependent on what type of weapon you are hit with. For example, radar-guided missiles with their exceptionally large warheads do considerably more damage than heat-seekers. Ground fire is the least effective of all in terms of doing damage, but remember the "golden BB" theory. It only takes that one-in-a-million hit in the right place to end your mission.

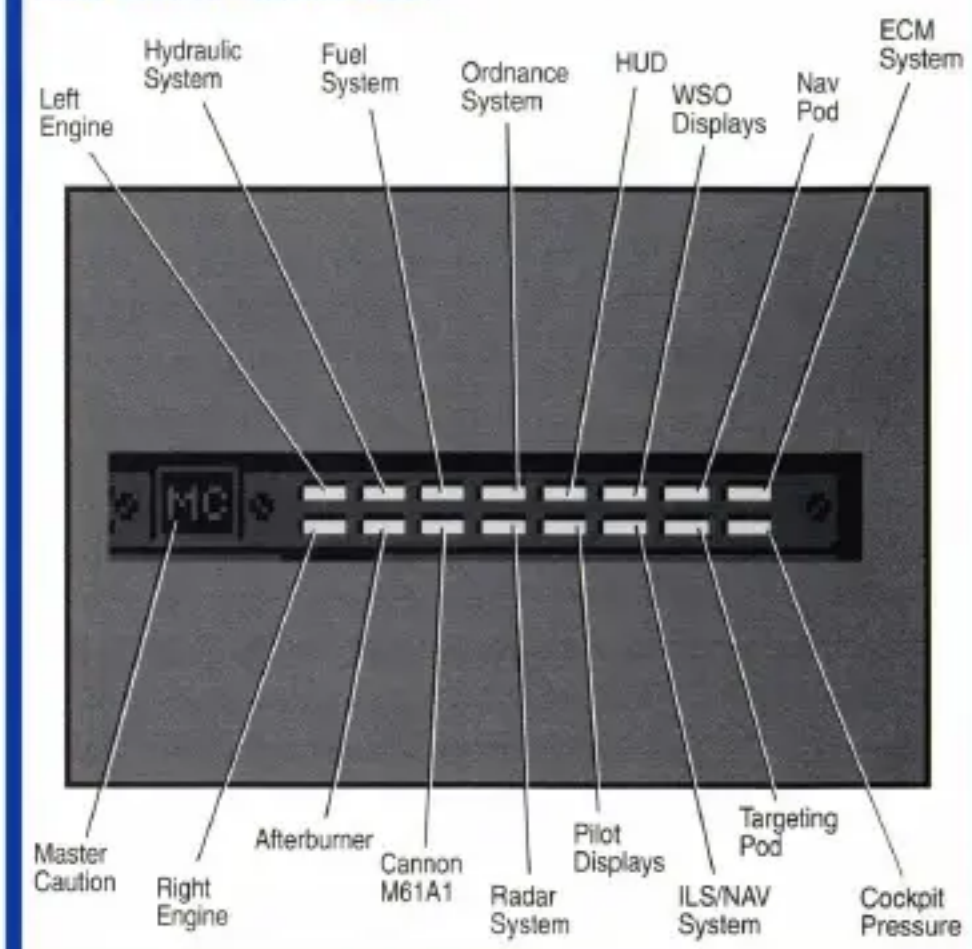
A missile hit is quite capable of causing damage to multiple areas. At the higher Difficulty Level settings, a single hit could conceivably knock out enough systems to render your aircraft unable to continue the mission.

DAMAGE ASSESSMENT

If your aircraft is damaged, it may not be immediately apparent what is wrong. The aircraft may just feel sluggish and unresponsive. To ascertain the exact nature of the damage, call up the Caution display for a text read-out of the damaged areas. Note that if the displays themselves are damaged, this may not be possible.

The Cautions Display can be displayed on any MPD/MPCD from any Master Mode. It lists all damaged systems. In the event one or more systems receives damage, the Master Caution (front and rear cockpits) panel light illuminates and remains illuminated. The Cautions Display then lists the affected system(s).

REAR COCKPIT - CAUTION LIGHT



If the MPD/MPCDs are damaged there is a secondary means of determining damage. The WSO has a visual checklist of damaged areas in the form of two rows of Caution Lights overtop his MPD/MPCDs. When these lights are illuminated, it indicates damage to that particular system.

With all MPD/MPCDs knocked out, the WSO's status panel is still a last ditch source of information on systems damaged. The Caution lights is follow the order of the damaged systems as outlined in the following schematic:

For example, the lower light in the fourth row from the left means that the AN/APG-70 Radar system has been damaged.

The areas (systems) which are susceptible to being damaged are listed below along with the effect(s) the loss of each has on your aircraft.

LEFT ENGINE

The engine shuts down and is no longer operational. Its portion of the total power contribution is no longer available. The **Engine Management Display** should reflect this loss.

RIGHT ENGINE

The engine shuts down and is no longer operational. Its portion of the total power contribution is no longer available. The **Engine Management Display** should reflect this loss.

HYDRAULIC SYSTEM

The F-15E's hydraulic system has been damaged. The control and response of the aircraft's fight surfaces is affected. In *Standard Mode*, the aircraft tends to climb or dive and/or slip to the left or right. Constant attention to flight control becomes a necessity. In *Authentic Mode*, landing gear which requires hydraulic pressure will not raise again once it is lowered. In addition, both wheel and speedbrakes are rendered inoperative.

AFTERBURNER

The afterburner is no longer functional. If engaged at the time of the loss, it automatically shuts down.

FUEL SYSTEM

Essentially, the F-15E's fuel consumption has now increased to twice the normal rate. The **Fuel Gauge** continues to reflect the current available fuel.

M61A1 GUN SYSTEM

The on-board 20mm cannon is no longer operational. The **HUD** displays "XXX" in the ammo remaining position when the gun is selected after this loss.

ORDNANCE SYSTEM

All remaining A-A and A-G ordnance is no longer operational. The two armament screens reflect this loss. "DAMAGED" displays across the center of each display.

AN/APG-70 RADAR SYSTEM

Both the A-A and A-G radar systems are no longer operational. The two basic radar screens reflect this loss. "DAMAGED" displays across the center of each display.

HUD

The **HUD** is no longer operational. It, along with the HUD Repeater, appears blank after this loss. If the HUD Repeater is displayed at the point the loss is taken, the MPD/MPCD blanks out. If part of a Master Mode default, system designated or player selected, the MPD/MPCD appears blank when that mode is selected. The blank MPD/MPCD can be reset to any other available display.

MPD/MPCDS PILOT'S COCKPIT

The three MPD/MPCDs in the pilot's cockpit are no longer operational. All three displays appear blank after this loss.

MPD/MPCDS WSO'S COCKPIT

The four MPD/MPCDs in the WSO's cockpit are no longer operational. All four displays appear blank after this loss.

ILS/NAV SYSTEMS

The **ILS** subsystem, **Autopilot** subsystem, and the **TSD**, **ADI**, and **HSI** displays are no longer operational after this loss. The displays are dropped from the available list of displays. If displayed at the point the loss is taken, the MPD/MPCD blanks out. If part of a Master Mode default, system designated or player selected, the MPD/MPCD appears blank when that mode is selected. The blank MPD/MPCD can be reset to any other available display.

LANTIRN NAVIGATION POD

In the event of this loss, the **TF** system, and the **NAV FLIR** are no longer operational. The **NAV FLIR** immediately disappears from the **HUD** and **HUD Repeater** display after this loss. The **HUD Repeater** display is still operational without the **NAV FLIR** background.

LANTIRN TARGETING POD

In the event of this loss, the **Targeting FLIR** is no longer operational along with the laser subsystem and laser-dependent weapons, i.e. GBU-10 and GBU-12. AGM-65D Maverick, GBU-15, and SLAM can still be employed, but their FLIR data link is inoperable. If displayed at the point the loss is taken, the MPD/MPCD blanks out. If part of a Master Mode default, system

designated or player selected, the MPD/MPCD appears blank when that mode is selected. The blank MPD/MPCD can be reset to any other available display.

ECM SYSTEM

The **TEWS** and **Jammer** subsystem are no longer operational. Chaff and Flares remain fully operational. If the **TEWS** is displayed at the point the loss is taken, the MPD/MPCD blanks out. If part of a Master Mode default, system designated or player selected, the MPD/MPCD appears blank when that mode is selected. The blank MPD/MPCD can be reset to any other available display. The **SAM** & **AI** cockpit warning lights remain operational.

COCKPIT PRESSURIZATION SYSTEM

In the event of this loss, the player may no longer fly above 18,000 feet without suffering a blackout. If above 18,000 feet at the time of the loss, the player will slowly blackout. If the pilot does blackout, all normal action continues.

AUTHENTIC MODE CHECK RIDE

Okay, you've presumably mastered the aircraft with features set to *Standard Mode*. Chances are you've shot down a fair amount of enemy interceptors and dropped bombs on your share of targets. Now it's time to really challenge yourself by setting your options to *Authentic Mode*. Are you ready?

YOUR FIRST MISSION

This Check Ride assumes that **all** Reality options have been set to *Authentic Mode*. It is designed to help you utilize these *Authentic Mode* features to the fullest. Again, to get the most from this Check Ride, have the Key Reference Card handy.

GENERATING THE CHECK RIDE MISSION

Before flying an *Authentic Mode* Check Ride, you first have to generate a mission. The theater and type of mission are unimportant, so choose the theater that most intrigues you.

Since mission assignments are handed out in the Briefing Room you must first go to the Home screen hangar area. Set-up a mission according to the instructions contained in the **Home Screen** section of this manual. For purposes of this Check Ride, be sure to set all the simulation parameters to Authentic and ON.

After receiving your mission, exit the Briefing room into the Arming Screen. Select AIM-120 AMRAAMs and AIM-9M Sidewinder missiles. Because these missiles are essentially "fire and forget," they are easiest to use for your first time out. Since weapon effectiveness is now taken into account, equip your aircraft with the air-to-ground ordnance best suited to destroying the targets you have been assigned.

This Check Ride gives an overview of the more essential aspects of *Authentic Mode* features only. It is intended to get you up and flying. Learning the more difficult methods of bombing and different types of ordnance is covered in their respective sections.

BEGINNING A MISSION

You begin a mission either on the ground at a friendly airbase or already in flight, fully fueled from a KC-10 Refueling tanker. If airborne, your aircraft is in level flight and ready to begin the mission.

If at an airbase, your aircraft begins already on the runway ready to takeoff. It isn't as simple as it sounds. The *Authentic Mode* flight model makes even taking off a challenge.

Take a deep breath and prepare yourself. When ready, fire up your engines by tapping ***Max Accelerate*** **(shft= key)**. In *Authentic Mode*, you need every bit of thrust possible to get off the runway, especially if loaded with ordnance. You must use the Afterburner to takeoff. Press ***Afterburner*** **(a Key)** immediately after firing up your engines or you may not get off the ground before running out of airstrip.

Notice that the engine noise increases as you accelerate and begin to roll forward down the runway. Keep an eye on the airspeed indicator located on the HUD. The small rectangle on the left shows your airspeed as it increases. The rectangle of the right is your altimeter and remains at zero feet until you lift off the runway. You begin the simulation properly aligned on the runway centerline so there is no need to worry about rolling off the edges.

Don't be in a hurry to get airborne. Stretch out the takeoff roll as long as possible in order to build up excess speed. Under no circumstances

should you try and lift off the runway at less than 190 knots. Even though it is possible to do so, the margin for error is very close. Why risk becoming a runway fatality?

When you have reached sufficient airspeed for takeoff, **gently** pull back on your *Controller*. Let the nose wheel lift off the runway. At this point you have probably used over two thirds of the runway. Let the airspeed continue to build and lift off the runway in the remaining third.

Gently pull back once again on the *Controller*. Align the Velocity Vector with the 10 degree line of the pitch ladder while climbing out. Your airspeed gradually builds while giving you a steady rate of climb without risking a "stall condition."

Now that you are airborne, there's no turning back. Notice the numbers inside your altitude rectangle increasing. Your airspeed is very low after lifting off, so don't perform any wild maneuvering or you risk "stalling" the aircraft. Maintain a 10 degree pitch attitude while you gain additional altitude and airspeed.

CLIMBING OUT

Once you are safely off the runway, raise your landing gear by tapping the ***Landing Gear* (g key)**. The Landing Gear [**G**] cockpit light is now turned off. This lessens the effects of drag on your aircraft and results in a noticeable increase in airspeed.

In the lower left hand corner of the HUD, your current Mach number and g-force being produced by your maneuvers are displayed. You receive this information when your landing gear is raised.

In Difficulty Level 1, your Weapon Systems Officer automatically raises the gear for you after reaching an altitude of 100 feet.

Although you may climb to any altitude you desire before leveling off, for purposes of this Check Ride, climb to an even 4,000 feet. This gives you plenty of time to experience the aircraft in a climb profile. You have time during the climb out to enjoy some of the external views. The ***Side View* (F6 Key)** in particular, gives you a great view of your pitch attitude.

LEVEL FLIGHT

After climbing out to 4,000 feet, the next step is to assume a level flight profile. From your 10 degree angle of attack, gently push your *Controller* forward. The nose of your aircraft drops accordingly. Add back pressure on the "stick" to stop the nose from dropping when the Velocity Vector is aligned with the solid horizon line.

Make fine-tuning adjustments until your altitude indicator is neither gaining nor losing altitude. You have reached level flight. Again, use one or more external view keys to get a picture of what the aircraft looks like in level flight.

Now that you have assumed level flight, you can safely shut off the afterburner by pressing ***Decelerate* (- Key)** once. Press ***Accelerate* (= Key)** to return to 100% (Full Military Power). You can check the RPM% on the Engine Management Display.

TURNING THE AIRCRAFT (BANKING)

Turning your aircraft is known as "Banking." Move the *Controller* either left or right gradually and watch as the aircraft begins to turn in that direction. Notice that the pitch ladder inclines toward the opposite direction as you turn. A closer inspection of the pitch ladder reveals that this is because the solid pitch horizon line has remained aligned with the horizon.

Release pressure on the *Controller* when the bank angle of the horizon is about 45°. To turn faster, pull back on the stick somewhat, but watch your speed (on the left of the HUD) and altitude (on the right). A tight turn with back-pressure on the *Controller* turns you much more quickly, but can slow your aircraft. The sharper the turn, the more g-forces are exerted by your aircraft.

The g-force indicator is located in the lower left corner of the HUD. It gives you the current amount of g's experienced by you and the aircraft. In *Standard Mode* you could ignore the adverse effects of g-force, not anymore. Too many g's in *Authentic Mode* will put you to sleep. In combat, ***If you snooze, you lose***.

Note that the longer you allow conditions causing the "redout" or "blackout" to continue, the longer you take to recover. In addition, the more you push the envelope, the sooner you will be affected.

FLYING ON COURSE

Now it's time to get onto the right course. Look at the horizontal scale across the top of your HUD. This is known as the *Heading Indicator*. The number directly in the center of the scale corresponds to your current heading in degrees.

Underneath the Heading Indicator is an inverted -V symbol. This symbol is known as a *caret* and indicates the bearing of the active Sequence Point from your aircraft. By turning the aircraft, you can align the Sequence Point caret with the center of the heading indicator. When the symbol is centered, it indicates that you are on course toward your first Sequence Point.

Now that you are on course, put the aircraft in automatic pilot by pressing ***Automatic Pilot* (p Key)**. In *Standard Mode* the automatic pilot puts you on a direct heading toward the active Sequence Point. In *Authentic Mode*, the automatic pilot levels your aircraft at its current altitude. Instead of directing you toward a Sequence Point, it simply maintains your current heading. In other words, automatic pilot keeps you flying straight and level without regard for Sequence Points.

SIMULATION VIEWS

Take this time to find the various view commands on the Key Reference Card. You can observe the scenery and your aircraft by using the ***Simulation Views* (F1- F10 Keys)** available to you.

There are fields of vision out the front, rear, and sides of the aircraft plus a number of external views. You can even switch to the back seat and manipulate the views from that perspective.

One particularly important view is the ***Padlock View* (F8 Key)**. This view allows you to visually search for targets without resorting to radar. Repeatedly pressing this key cycles through all eligible enemy targets in the area.

ENJOYING THE FLIGHT

In *Standard Mode*, once your aircraft was on course you could relax. In *Authentic Mode*, there is just too much pre-strike preparation that needs to take place before you can do much sightseeing. After all, this is no joyride. As a pilot, you will undoubtedly develop your own checklist of tasks to perform and when to perform them. But for now, these are some of our suggestions.

ECM JAMMER ACTIVATION

One of the first things to do is activate the Jamming System by pressing ***Activate Jammer* (j Key)**. The Jammer only functions when a radar-guided missile has been fired at your aircraft. Note that there is a difference between being "activated" and actual functioning. The words "Jammer Activated" appear across the bottom of your TEWS display when it is functioning. While in the normal active mode, it does not affect your EMIS status.

SET CRUISING SPEED

It is not fuel efficient to tool around the countryside with your engines maxed out at 100% power. Press ***Decelerate* (- Key)** once or twice to reduce your power setting to 80-90% (Cruising Speed). It saves fuel and gives you more time to improve your Situational Awareness. Press ***Look Down/Look Up* (/ Key)** to check your power setting on the Engine Management Display.

SET YOUR MASTER MODE

Another important task is to place your aircraft to the proper Master Mode. This depends on what type of threat or activity you are anticipating first. If the presence of enemy aircraft is likely, you want the Master Mode set to Air-to-Air. If, however, you are going to be attacking ground targets first, you obviously want the Master Mode set to Air-to-Ground.

The MPD/MPCD screens are initially defaulted to a set-up which should optimize the flow of information you need to complete the mission. Feel free to change them at your leisure.

CONTACT THE AWACS

An AWACS aircraft is on standby to assist you during your mission. To receive the latest information on enemy interceptors along your route, press ***Picture* (shft p Key)**. The AWACS responds with various reports of friendly and enemy aircraft in your vicinity. Because the AWACS is handling a number of aircraft in addition to yours, do not make repeated calls too quickly. This ties up the AWACS operators.

MAKE A QUICK SWEEP OF THE AREA

In any case, as you approach enemy territory it's a good idea to make a quick radar sweep of your own. Press ***Radar Activate* (r Key)**. Keep the radar emitting for approximately 10-15 seconds, enough time to cover all 6 bars and azimuths. You also want to perform a 360 degree turn to clear your "six" of possible bandits.

Get a good look at the situation all the way out to the radar's maximum range (80 nm). Once you are satisfied nothing is out there, put the radar back into SNIFF mode. Fly another 40 nm (half the radar distance) and activate the radar once again. Repeat this action until it is clear that the enemy has spotted you.

Note that the EMIS light directly over MPD #1 illuminates while the radar is functioning. This indicates that your aircraft is emitting detectable energy in the form of radar waves. Although the F-15 is not intended to be a stealth aircraft there are techniques which make your aircraft difficult to detect. The main thing is to keep the use of radar down to a minimum.

CHECK THE TEWS

Continually check the TEWS display to see if enemy aircraft or ground installations are looking for you. Using the TEWS keeps you from having to use the radar frequently. Of course, once enemy icons begin appearing (especially diamond shaped aircraft icons), activate the radar immediately. There's no sense keeping it off, once they've found you.

ASSUMING A PROPER ALTITUDE

Your initial climb-out took you up to 4,000 feet. Now, it's time to start thinking about what is going to be the best altitude for penetrating enemy airspace. In *Authentic Mode*, it takes too long to gain altitude so you want to already be at your mission altitude before you get to the target.

The best way to avoid detection is to fly as low as you dare. Over water, flying low is a snap so try to maximize the use of large bodies of water. Over land, however, it's a bit more difficult. At low altitudes the range of your RBM radar is severely limited and designating targets becomes problematic. Deciding on the proper mission altitude is a trade-off between detection and accomplishing the task at hand. You have to make the call, that's why you're getting the big bucks.

DETECTION

Sooner or later you are bound to be detected. When that happens, consider if it would be more advantageous to be at a high altitude to maneuver against enemy interceptors or lower to evade possible SAMs. Once again, as pilot in command. It's your call.

USING THE TEWS

Again, the best defense against being surprised is your TEWS. The TEWS detects enemy radar emissions at a greater distance than your radar and gives you plenty of time to take appropriate counter-measures.

Your first indication that the enemy is out there should be the audio warning and Quadrant lights of the TEWS coming on. Now you know that they are looking for you. The Quadrant lights give you a rough idea of where the SAM radars and GCIs are located. Avoid them if possible. If it is not possible to steer clear of them, try and get as close to the deck as possible.

Despite your best efforts, enemy radars are likely to eventually begin tracking you. Enemy radars that are tracking your aircraft appear as icons on the TEWS display. Your TEWS Jammer then activates to suppress these radars before they can be used to launch a SAM.

DEALING WITH ENEMY AIRCRAFT

Enemy aircraft do not appear on the TEWS display until after they have "locked" onto you. Once this happens, the [**AI**] warning light (Airborne Interceptor) appears over MPD #2. **Therefore, if you see a diamond-shaped icon on the TEWS, you have a problem which needs immediate attention.**

MISSILE SELECTION AND THE TRIPLE LAYERED DEFENSE

Your F-15 is equipped with two different types of missiles: **radar-guided** and **heat-seeking** missiles. Radar-guided missiles come in two types: medium-range AIM-120A AMRAAMs and AIM-7M Sparrows. Only one type of heat-seeking missile, the AIM-9M Sidewinder, is carried aboard the E-model Eagle. You are able to select which of these missiles are in priority by pressing either ***Short Range Missile*** **(2 Key)** or ***Medium Range Missile*** **(3 Key)**.

It is a good idea to place your medium-range missiles "in priority." (Placing a weapon "in priority" means selecting that weapon to be fired) Press ***Medium Range Missile*** **(3 Key)**. With your radar-guided missiles at the ready you now have created a triple layered defense which is difficult for an enemy aircraft to penetrate.

Your first line of defense are your medium range "fire and forget" AIM-120 missiles. Usually you can engage aircraft with AIM-120 AMRAAM missiles from medium range and shoot them down before they are able to return your fire. Because your AMRAAMs are "fire and forget", you can launch a salvo of missiles and direct each of them at a different target. By staying at arm's length, you are in no danger of being hit by the enemy's shorter ranged missiles.

The problem is that you will run out of missiles long before the enemy runs out of aircraft. Once you have fired your medium ranged AIM-120s, the enemy now has an opportunity to close and engage you. With your AMRAAMs gone, your next line of defense is the shorter-ranged heat-seeking Sidewinder missile.

Once your last air-to-air missile is expended, the third and final line of defense is the 20mm Vulcan gun. In modern air combat, a gun is a weapon of last resort, so never fly with your guns in priority if you have missiles remaining.

AIR COMBAT (FLYING DEFENSIVELY)

In the previous section on air combat you learned in detail how to use your radar and missiles to destroy opposing interceptors. In this section the emphasis is on defensive tactics that help keep you from becoming just another statistic.

In *Standard Mode*, the TEWS gives you a more than adequate view of the tactical situation surrounding your aircraft. This view extends out 80 nm in all directions which by coincidence is also the maximum of your radar. Therefore, keep your use radar down to a minimum. By using your radar sparingly, you cut down on the amount of detectable energy emanating from the aircraft (EMIS).

Use the excellent intelligence provided by the TEWS to avoid heavy concentrations of SAM batteries and radars. The TEWS also gives you visual clues as to which direction enemy aircraft are facing. By staying low with the radar in SNIFF mode, you should be able to sneak up on enemy aircraft before they can detect you.

In the event an enemy aircraft is able to close on you and launch a missile, you still have a number of options available to you. Try to turn inside the missile and shake it off your tail. If maneuvers fail, begin dropping ***Chaff* (c Key)** and ***Flares* (f Key)**. These counter-measures (ECM) serve to decoy missiles away from your aircraft.

You cannot win an air combat by flying defensively, you can only achieve a tie. You must at some point in the fight be able to turn the tables on your attacker. Switch to ***Short-range missile* (2 Key)** or even ***Guns* (1 Key)** once the combat gets up close and personal. Keep your opponent in sight using ***Padlock View* (F8 Key)** and seek to take advantage of his mistakes. Two quick pointers: 1) never fly straight and level for more 10 seconds at a time and, 2) alternate your speed by applying afterburner and speedbrakes.

Surface-to-Air missiles require an entirely different approach to defensive flying. Again, the best way to beat a SAM is to avoid its radar controller or GCI. SAMs are totally dependant upon radar guidance so if you can avoid being detected the SAMs will remain on their launchers.

If you are detected, fly low and fast. You might not outrun a SAM but you may be able to use the natural terrain as a shield. The mountains and valleys of central Korea are perfect for this. The flat desert terrain in Iraq presents more of a challenge.

Use your internal Jammer. The Jammer works to interfere with a radar's ability to track and lock-on your aircraft. Since SAMs need guidance from ground radar, your Jammer suppresses the enemy's ability to launch missiles.

The TEWS gives you the ability to spot incoming missiles. Use the TEWS in conjunction with the maneuvers described in Chapter 3 to out wit any missiles that manage to get launched in spite of your jamming. Not all missiles are alike, however. Pay attention to the type of missile coming your way. SA-2 "Guideline" missiles are easily outmaneuvered whereas SA-5s are a different story.

ATTACKING GROUND TARGETS

Having eliminated any interceptors looking to stop you, the way has now been cleared to perform your assigned mission; ground attack. Air-to-Ground combat is best conducted from the back seat of the aircraft. You have four MPD/MPCDs at your disposal and in view at all times.

Switch your view to the WSO's perspective in the back seat using the ***Front/Back Seat* (' Key)**. Set the MPD/MPCDs to the proper display views. Your displays should be set to accommodate the target acquisition and delivery method best suited for the ordnance you're carrying. Note that the MPD/MPCD default set-up for Air-to-Ground Mode is able to handle all delivery methods.

There are several different ways to designate targets; RBM/HRM, Targeting FLIR, HUD Target designator and HUD Pipper designator. Some ordnance requires that a certain type designator be used. For the most part, however, the method of target designation is up to you.

If using the RBM and HRM to designate targets remember to utilize an indirect approach to the target. The RBM blind zones prevent you from heading directly at a target when trying to generate HRMs. Additionally, because of the mechanics of RBM squint angles, you are able to generate HRMs faster if looking at the target from the side.

To get around the limitations of your RBM/HRM designation system, try the following Ingress technique. Approach your target head-on at full afterburner until you reach a distance of about 40 nautical miles. At 40 nm, call a break turn and fly with the target at an angle of about 30 degrees.

Slow down now and use the RBM to begin generating HRMs. At a range of 20 nm, scale your HRMs down to 1.3 nm. When you are satisfied with the clarity of your HRMs, turn into the target again. Go to full afterburner and assume a direct approach toward the ASL appearing on the HUD. Depending on the delivery method and ordnance carried, maintain this direct approach until release.

Previous sections explain in detail how to designate targets, that information will not be repeated here. Suffice to say that once a target has been designated, there are three primary delivery methods; **Guided**, **AUTO Mode**, and **CDIP Mode**. **Laser-designated** delivery is actually a sub-set of AUTO and CDIP. Each of these methods best serves a particular family of ordnance as follows;

Guided Delivery Mode: Guided delivery is used in conjunction with self-guiding weapons such as the AGM-65 Maverick, Harpoon, SLAM, and GBU-15. Once a target is designated and brought within the weapon's constraints, all that is required is to fire the weapon. The weapon guides itself to the target without further help from you.

Since these weapons are "fire and forget," launch them and move out smartly. Don't hang around to watch. It's not necessary and it exposes your aircraft to enemy fire for no reason. If you just want to see the explosion, switch to a rear view and watch while you're on your way home.

AUTO Mode: AUTO delivery mode is best used when carrying free-fall bombs such as MK. 82s, Mk. 84s, Durandals, etc. These unpowered, unguided munitions are referred to as "dumb" bombs. Aptly named, these weapons simply fall off your aircraft when released and hit the ground according to the laws of gravity.

AUTO mode facilitates dropping "dumb" bombs by displaying a Azimuth Steering Line (ASL) extending from the designated target. Line up your aircraft's heading with the ASL. A horizontal release cue bar gradually drops down the ASL toward the target reticle. When the Time to Release (TREL) reads under 10 seconds hold down the ***Pickle Button* (spacebar).** The ordnance is automatically released at the proper moment.

The drawback to AUTO mode is that once your aircraft is lined up with the ASL, you're required to maintain that heading until the bombs are released. Flying straight and level over a heavily defended target could prove hazardous.

CDIP Mode: This delivery mode is used with the same ordnance as is used with AUTO Mode. It is a manual delivery system that leaves decisions up to the Pilot's discretion. All that is required is that the intended target by located within the target reticle when the ordnance is released.

Pop-Up Bombing is uniquely suited to CDIP mode. Begin your approach at a low altitude. At 6 nm begin a sharp inverted climb keeping a eye on the target using your Padlock view. Convert the climb into a shallow dive when nearing the target. Line of the target reticle, release your ordnance and exit the area quickly.

CDIP has both good and bad features. On the positive side, you are not required to designate targets before attacking them. CDIP allows you to drop bombs on targets of opportunity as you spot them. It is a completely passive delivery method which is undetectable. On the negative side, it is the least accurate of all delivery methods. Because it does not use guidance systems, accuracy depends entirely on the Pilot. It requires practice to get good at using this method.

Laser Delivery Mode: Laser delivery is used in conjunction with GBU-10 and GBU-12 bombs. It is particularly useful at night when other optical systems are less effective. The Laser designator is generated by the Targeting FLIR which gives you launch cues when the target is within range.

Because the GBUs are not powered, the range of this delivery method is limited to the glide distance of the bombs. Laser delivery also requires that you continue to designate the target right up until impact. This is somewhat more risky than Guided mode. You are required to fly right into the teeth of enemy fire and stay there until the bombs hit.

RETURNING HOME AFTER THE MISSION

After one or both targets are attacked, it's time to come home. Chances are that your mission has attracted a good deal of attention. Don't fall victim to the *Get Home Syndrome*. That is, concentrating on getting home in a hurry while neglecting to keep tabs on the enemy. Failing to notice enemy interceptors lining up on your tail may keep you from getting home at all.

Take a minute to judge the total situation. Don't waste time mixing it up with every enemy fighter you happen to see. Pick out only the enemy aircraft that have a possibility of catching you. Concentrate on destroying them with your remaining air-to-air ordnance while maintaining a general heading toward home.

Another important consideration is your fuel status. Be sure to check the amount of fuel you have remaining on the EMD. The straight shot home might not always be the safest. If fuel allows, deviate your course to avoid heavy concentrations of enemy ground forces.

To return home, simply toggle the ***Next Sequence Point +*** **(s Key)** until you see "home airbase" or "tanker track" appear above your HUD. Note that the Sequence Point caret has changed to a new position underneath your heading indicator. This shows you the straight line heading you need to fly in order to return to your base.

You may now engage the Automatic Pilot by pressing ***Automatic Pilot*** **(p Key)**. The [**A**] Cockpit light illuminates to indicate that the Automatic Pilot is engaged. The automatic pilot will keep the aircraft on a steady heading, requiring only minor course adjustments until you reach your destination.

LANDING

Except for Difficulty Level 1 flight, the automatic pilot is unable to land the aircraft for you in *Authentic Mode*. You are on your own. The key is to begin early. Once the airbase is in sight, it is probably too late to start thinking about landing. You never have enough hands to perform all the last minute tasks needed to land an aircraft, so start preparing while you are still many miles away.

All ground runways are oriented North-South (360 degrees-180 degrees). Because airbase traffic patterns are one-way (just like traffic on the ground) your approach should always be from the south. In other words, takeoff and landings should always be performed south to north on a heading of 360 degrees.

Although you may land the aircraft "against traffic," courteous pilots will take the time to do it right. Always watch out for other aircraft in the traffic pattern. You may not hit them, but you'll sure scare the heck out of the other pilots.

Landing an aircraft is simply being able to manipulate airspeed and altitude in order to reach zero/zero; ending up on the runway at 0 knots and 0 altitude. When performing manual landings, you will have to judge these things for yourself.

Step one is to line up properly with the runway while you are still at least 15 nautical miles away. Begin your approach around 1,000 feet; this gives you some useable altitude in case of an emergency while on "final."

Maintain a straight and level approach to the runway while slowly reducing your engine power setting to 50%. Keep an eye on your altitude while your airspeed bleeds off. You want to begin a **gradual** descent. At no time do you want to dive at the runway. The nose of the aircraft should always remain slightly pitched up. This nose-high attitude the aircraft assumes when landing is called a "**flare**."

Remember, the idea is to glide in and not fly into the runway. You should be continually losing altitude throughout your approach without having to dip the nose of the aircraft. If you find yourself losing altitude too rapidly, increase your power by 10%. If you are descending too slowly, you are probably travelling too fast. Extend your ***Brake*** **(b Key)** or decrease your power setting. The closer you come to the runway, the slower you want to be moving.

As you cross over the threshold (the painted area at the end of the runway), aim for an altitude of less than 200 feet and an airspeed of 145-165 knots. If your aircraft begins to stall, bump up your airspeed so that you are flying just above a stall. "Flare" the aircraft (pitch the nose up) so that the first thing to touch the ground are the rear wheels.

Try to touch down in the first half of the runway so that you'll have room for a roll-out. When your wheels touch the runway, cut your throttle and make sure your Brake is engaged. Check for the [**B**] Instrument light in the Cockpit and press ***Brake*** **(b Key)** if it is not engaged. Once you have come to a full stop, the Control Tower calls to indicate you have made a safe landing. **Remember the old saying; Any landing you can walk away from is a good landing**.

INSTRUMENT LANDING SYSTEM (ILS)

The F-15E is equipped with an Instrument Landing System (ILS) that is tied directly into the Navigation mode HUD. This system is designed to assist you in lining up with a runway and determining the proper glide slope for landing.

Each friendly airbase is equipped with an ILS beacon which projects an electronic beam away from the runway. The beam is exactly aligned with the runway's heading so that an aircraft riding the beam is properly lined up to land. The beam is elevated off the ground so that it also assists in setting a glide slope.

USING THE ILS

The ILS is only activated under certain circumstances. First, the radar must in NAV Master Mode. Your landing gear must be extended and your aircraft must be within 20 nautical miles from a friendly airbase. The primary means of viewing the ILS is through the pilot's HUD. However, the ILS may also be used in conjunction with the ADI and HSI displays if necessary.

The ILS consists of a Bank Steering Bar and Glide Slope Indicator. These two bars (vertical and horizontal lines) move left and right, up and down according to your current position on approach. When you are properly lined up on the glide path, these two bars meet to form cross-hairs centered on your HUD.

BANK STEERING BAR (VERTICAL BAR)

The Bank Steering Bar is a visual cue that indicates your aircraft's position in relation to the runway. If the bar is located left of center in the HUD, your aircraft's course is right of the runway. If the bar is located right of center in the HUD, your aircraft's course is left of the runway.

To get on course, alter your aircraft's heading in the direction of the bar. As you turn, the bar begin's to center itself on the HUD. Make minor course corrections to keep the vertical bar centered. As long as the bar is centered, you are on the proper course for landing.

GLIDE SLOPE INDICATOR (HORIZONTAL BAR)

The Glide Slope Indicator is a visual cue that indicates your aircraft's proper altitude in relation to its distance from the runway. Naturally, the closer you get to the runway, the lower your aircraft should be. The altitude and distance relationship sets up a safe glide angle.

If the horizontal bar is above center on the HUD, your aircraft is too low. Conversely, if the bar is below center, your aircraft is too high. In order to stay on the glide slope, you must gain or lose altitude accordingly. Having reached the proper altitude, keep the bar centered to remain within the glide slope.

A good rule of thumb is the nearer you are to the runway, the lower the glide slope. If you find yourself too low in the glide slope, you have the option of maintaining your current altitude. As you get nearer the runway, the glide slope indicator begins dropping until you are once again properly aligned.

Note that you should perform ILS assisted landings in conjunction with the symbology displayed on the HSI. Rather than repeat that information here, refer back to the MPD/MPCD section HSI listing for details.

CONGRATULATIONS! YOU'VE SUCCESSFULLY COMPLETED YOUR AUTHENTIC MODE CHECK RIDE. NO DOUBT YOUR "WIZZO" IS ALSO GLAD YOU MADE IT BACK.

SJ
4FWG

3. PRINCIPLES OF AERIAL COMBAT

I. FUNDAMENTALS OF FLIGHT

THE FOUR FORCES

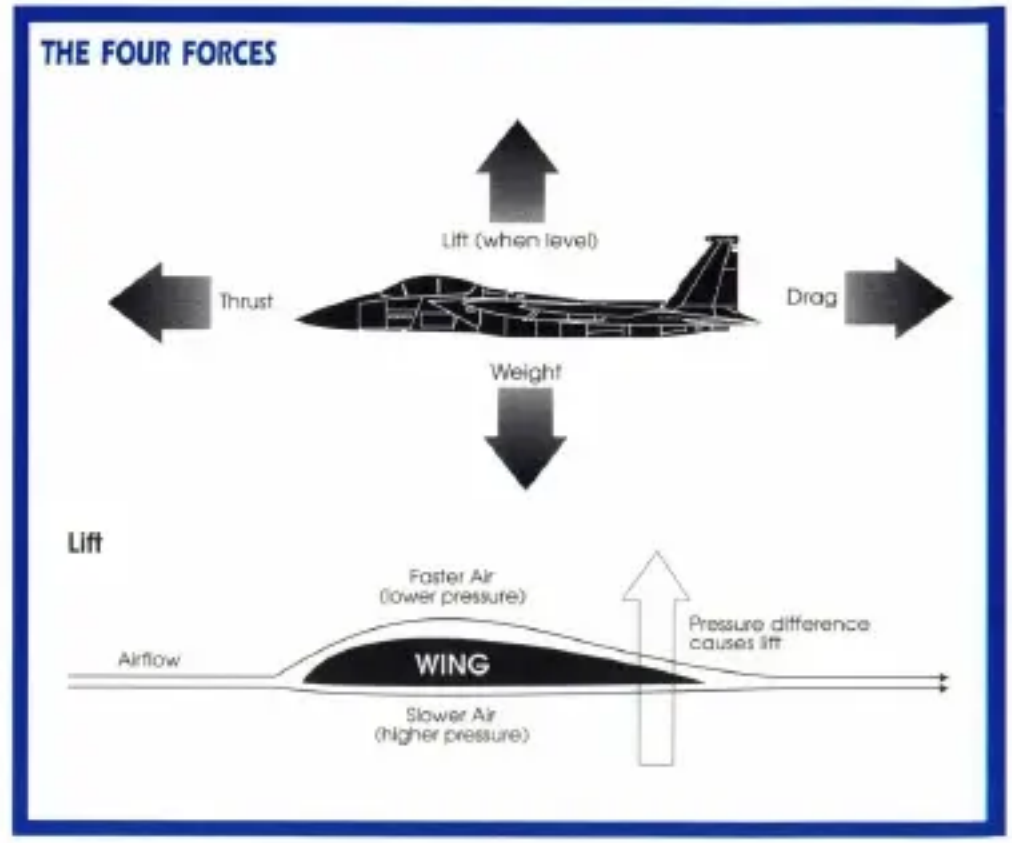
There are four basic forces which affect each and every object which moves through the air; **Lift, Thrust, Drag, and Gravity**. The same forces which act upon a football to determine how far it is thrown also affect huge airliners with hundreds of people aboard. Controlled flight is the art of managing these four forces in order to travel through the air and reach a desired destination.

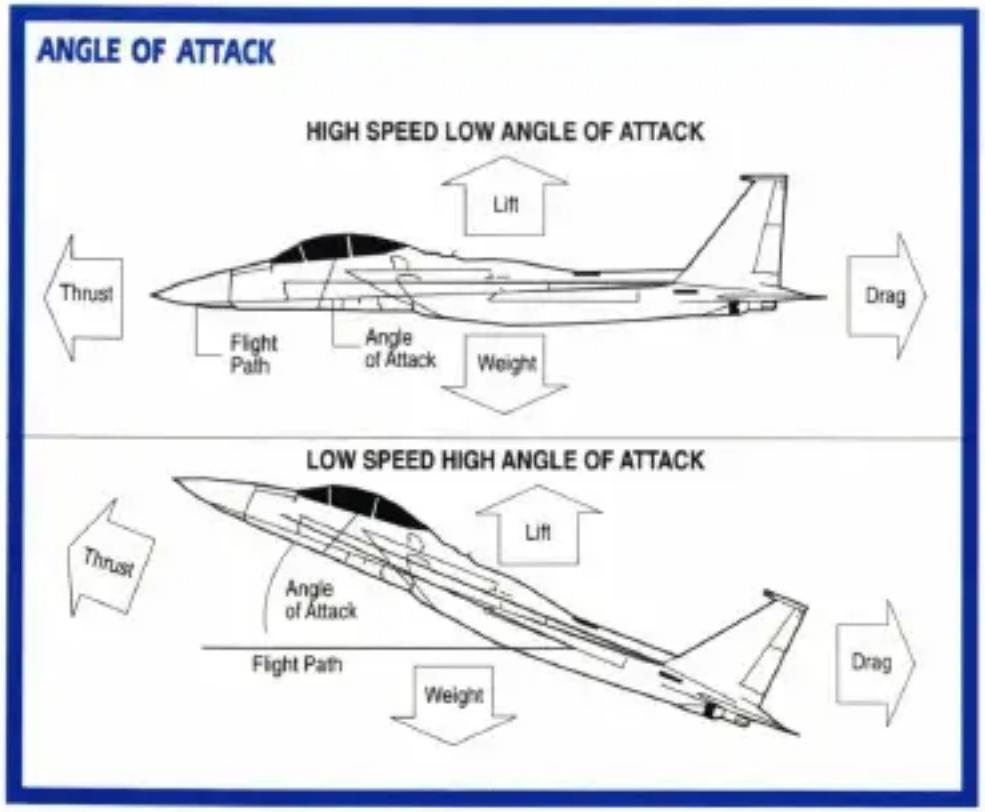
Lift is perhaps the least understood of all the forces which affect aircraft. Lift is the difference in air pressure, above and below an object, caused by air rushing past it. As air strikes the leading surface of an object, the even flow of air is deflected over, under, and around the object. These deflected air streams change speed as they are forced past the object.

In the case of an airplane, air moving over top of a wing surface moves at a greater speed than the air moving below. Since slow moving air has a higher air pressure, it causes the wing surface to rise. As the speed of the air moving over top of the wing surface increases, the difference in pressure above and below the wing becomes greater. The greater the difference in pressure becomes, the more Lift is ultimately generated.

This same principle works on any object, not just wing surfaces. To test the theory, one only has ride in an automobile with a hand extended into the wind. (*Remember to exercise caution when performing this experiment*) The air striking your hand from underneath will force it upwards because of the difference in air pressures.

Thrust is the aerodynamic force which propels an object through the air. The principle is the same whether the wing is pulled through air by a propeller or pushed from behind by a jet engine. The purpose of Thrust is to force air across the wing surface in order to create Lift. Obviously the faster an object moves through the air, the more air is forced past the wing.





To explain the principle behind Thrust we can refer back to our automobile experiment. By depressing the car's accelerator pedal, the driver adds power to the engine (Thrust) which in turn converts this additional energy into speed. As the automobile increases speed, more wind is forced past your hand causing it to rise. Notice that slowing the car down has an opposite effect.

Drag is another force which is often misunderstood. To grasp the concept, it is first necessary to separate Drag from the idea of weight. Aerodynamic drag is anything which impedes the movement of an object through the air.

While weight is a counter-balance to Lift, Drag is in direct opposition to Thrust. The more Drag created by a moving object, the greater amount of thrust is needed to overcome it. Returning yet again to the automobile experiment, Drag is the difference between keeping your hand horizontal, pointing in the direction of travel and raising a palm into the wind. Your palm creates more drag than your fingers slicing through the air like a knife.

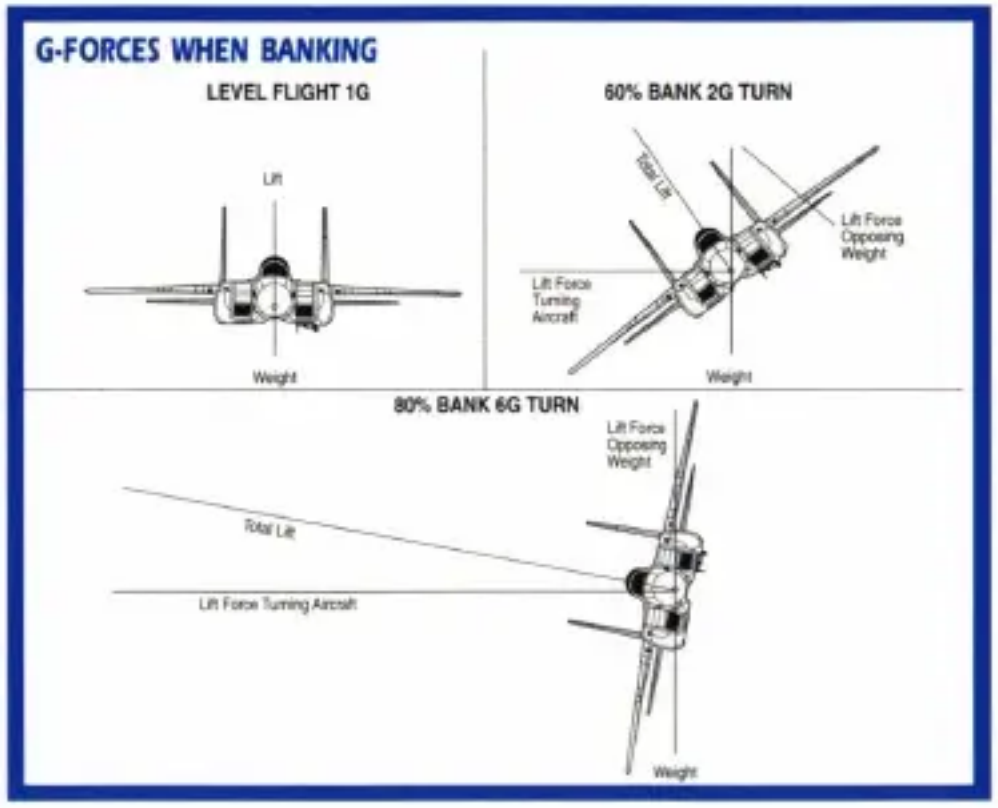
The last of the four forces and the only one we cannot control to some extent, is **Gravity**. Gravity is the force behind the saying, "Whatever goes up, must come down." It must constantly be overcome by Lift in order for anything to remain airborne for long. If the force of Gravity becomes greater than the Lift being exerted, the object wing will be drawn toward the ground, eventually ending the flight.

ANGLE OF ATTACK (AOA)

The amount of lift generated by a particular surface is a function of its "angle of attack." Basically, AOA is the difference between the aircraft's flight path and the "chord line" of the wing. In level flight, the "chord line" of the wing is facing directly into the airflow. When climbing, the "chord line" of the wing is pitched upward relative to the airflow. With its nose and wing pitched up, the aircraft is said to have increased its angle of attack. The reverse is true when diving.

STALLING THE AIRCRAFT

It is a common misconception among the non-flying public that "stalling" an aircraft means trouble with the engines. If this were true, gliders (which have no engines) would be in a permanent stall. That simply isn't the case.



Stalling an aircraft refers to a condition which occurs when a wing fails to produce the amount of lift needed to maintain flight. In other words, a stall is the lack of an adequate airflow passing under the wings to overcome the force of gravity.

It is important to note that speed, pitch attitude, and bank inclination are all factors in determining whether a plane is about to stall. An aircraft in level flight may stall if it attempts too sharp a turn without increasing its speed. This is due to insufficient lift being generated by the wing in direct opposition to gravity's effect on the aircraft.

The effects of a stall are different depending on the aircraft. Some aircraft simply assume a mild nose-down attitude until returning to level flight. Other aircraft may enter a sudden and potentially dangerous spin. On low level missions a pilot may not have time to recover before striking the ground. This is especially true if one wing stalls before the other.

Hans Halberstadt/Arm Communication

II. AIR TO AIR COMBAT (DOGFIGHTING)

During the normal course of a mission, an F-15E should not be used as an interceptor. That type of mission should be left to the Eagle-Charlies. That's what they are there for. However, there may come a time that you are engaged in air combat at a time and place not of your choosing.

If your aircraft is engaged while returning from a mission the enemy will quickly discover that without ordnance the F-15E retains all of its exceptional dogfighting ability. But, if you are "bounced" while in-bound to the target area, a fully loaded F-15 will be fighting at a disadvantage.

The worst time to become engaged is always on the approach to a target. Your back-seater will have his head "inside the cockpit", preoccupied with delivering ordnance. While it is not impossible to dogfight while loaded with ordnance, it is exceedingly difficult. Certain maneuvers are out of your flight envelope.

In most instances, an aircraft will jettison ordnance if attacked. This automatically aborts the mission since you may as well return to base. If however, you decide to retain your ordnance, you must assume an offensive posture early in the fight.

The following section is offered as a brief familiarization with air combat. It includes how to perform maneuvers that have been common to dogfighting since 1915. Performed correctly they will help you in gaining the advantage over attacking aircraft or aid you in escaping from unfavorable situations.

HOW TO FIGHT

Assuming you have read the preceding chapter on how to fly an F-15E, you are now ready to take on the opposition. Its a cruel world out there and there are no points for second place. This section is dedicated to giving you some tactical experience before you go head-to-head with your first MiG-29.

Aerial combat tests all your flying skills during periods of extreme stress. Engaging an enemy aircraft requires split-second timing. Reactions in combat must be instinctive since there is little time for decision making travelling at Mach 1.

The first thing every pilot should learn in order to become a top-notch fighter-jock, is **Energy Management**. The principle behind energy management is being able to fly the aircraft while maximizing the benefits derived from the four forces discussed earlier. Used properly, the "Big Four" can give you distinct advantages in combat. Ignoring them only leads to trouble.

Think of your F-15's flight envelope as being egg shaped. In the horizontal plane, it will fly a perfect circle if constant g-force and speed are maintained. In the vertical plane, however, the circle will be distorted by gravity. At the top of the circle, the fighter will be traveling slow and turning tightly. Near the bottom the aircraft will have picked up speed during its descent and have a much longer and flatter arc.

To begin with, a pilot that is caught flying low and slow is a poor manager. Granted, sometimes a pilot is forced into this predicament by circumstances beyond his control. A pilot found in such a situation has few options if "bounced" by enemy fighters. He cannot accelerate fast enough to escape nor can he trade altitude for speed. Low and slow is a deadly combination. Remember, speed equals life.

An aircraft does not carry enough fuel to allow a pilot to fly in full afterburner throughout an entire mission. Afterburners are fine at high altitudes where the air is less dense and offers less resistance (Drag). But the heavier air at low altitudes causes an afterburner to use too much fuel for practical use.

Remember also, that the IR signature of an aircraft's jet-engine is like a beacon to heat-seeking missiles. The more throttle you apply, the better IR target you become. So, pilots must learn to make the most of the speed that is available to them.

The primary means of gathering speed without boosting the throttles is to point the nose of the aircraft down. Even shallow dives of short duration enable an aircraft to build-up considerable momentum. Converting this momentum into speed is a tactic which can only be used for so long. Sooner or later the aircraft must either pull out of the dive or strike the ground.

One sure way to lose all the energy you've built up in the dive is to pull up too abruptly. To transition from a dive, gently pull back on the stick until your wings are horizontal to the ground. Your energy and airspeed will then bleed off gradually. This way you are making the most of your dive momentum. Diving is like energy stored in a battery. A battery releases its energy gradually and only as needed. It continues to provide energy until it runs out of juice.

Another way of losing speed unnecessarily is by making high-g turns when less sharp turns would work equally well. Even aircraft as aerodynamically maneuverable as the F-15 have trouble sustaining high-g turns for long. Try it once and watch how rapidly your speed drops off. Once you load-up your wings in a sustained turn, all your lift is being directed horizontal. The aircraft runs the risk of stalling since nothing is being used to oppose gravitational forces.

Of course, the most obvious way to lose energy and air speed is by climbing. Increasing your altitude is like putting money in the bank for future use. The more altitude an aircraft possesses, the more potential energy will be available once in combat. The problem is that the higher you go, the more visible you become. As the pilot, you must be judge whether flying at a higher altitude is worth the added risk.

Jane's Defense Group

Energy management is a necessary part of everyday flying but is absolutely essential once in combat. Not only do you need to remain aware of your own aircraft's energy status, it is always a good idea to pay attention to what the other guy is doing with his aircraft. Watching the other guy is part of another major element involved in air combat, Situational Awareness.

Situational Awareness (or SA, in fighter-speak) is the concept of taking in the whole picture. New pilots become so focused on their own aircraft that they lose track of what is going on around them. In a effort to shoot down an opponent, a pilot may forget to look out for the enemy's wingman until it is too late. Bearing in for the easy kill, the novice often finds another "bandit" tucked neatly in his "six."

Two-seat aircraft, like the F-15, have the advantage of a second pair of eyes when it comes to SA. The "GIB" (Guy In Back) is usually detailed to take some of the work load off the pilot. In return for the free ride, the Wizzo must be able to spot enemy aircraft the pilot may have missed.

Although air combat is a three dimensional affair, inexperienced pilots tend to fight in only two. Pilots must learn to fight in the vertical as well as horizontal plane. As part of a pilot's situational awareness, he must be able to judge the distance relationships between his aircraft and the enemy's. Adding a third dimension to combat sometimes distorts this spatial perception.

Despite some truly remarkable advances in technology, the basics of air combat have not changed since the Wright brothers. Missiles and jet engines have quickened the pace of combat considerably but a dogfight is still a dogfight. The human element has remained the one constant in an ever changing world and air combat continues to be a man against man proposition. The better man almost always wins, even when flying an inferior aircraft.

In fact, modern gadgetry often hinders rather than assists a pilot in completing his mission. The noise generated by all these systems is deafening and a distraction. Imagine having to concentrate on SAM warnings, missile-ready growls and your back-seater talking all at the same time. Add to that vector commands and real time intelligence coming over your headset from an AWACS. The pilot rapidly experiences an information overload and no longer hears anything being said.

Many pilots in the Vietnam era went through a personal check list whereby they began turning off various systems as soon as they left the ground. The advanced systems in contemporary fighters are nice to have but in the final analysis only a pilot's skill and instinct will bring him home.

The most important quality for fighter pilots to possess is the self-confidance of being number one. Fighter pilots by nature are aggressive "go-getters", not afraid to use their God-given initiative. One thing they are not, however, is reckless or foolhardy. Even though fighter-pilots tend to push themselves to the limit, they are also professionals trained to instinctively calculate the risks they take.

"Only the spirit of attack born in a brave heart, will overcome the odds."

—Adolf Galland, WW II Luftwaffe Ace

THE FIVE PHASES OF AIR COMBAT

Despite how aerial combat looks in the movies there are five distinct phases of every engagement. Only after the aircraft become locked in a "furball" does the battle take on these familiar "Hollywood" characteristics. Dogfighting is just one phase of aerial combat. The losing pilot has usually already been defeated before it reaches this phase. He just doesn't know it yet.

1. DETECTION

You can't shoot what you don't see. Detection is perhaps the most critical of all the preliminary phases of combat. The fast paced nature of modern combat allows little time for decision making. Therefore, getting even a few seconds jump on your opponent can mean a great deal. Early detection of an enemy allows you to begin your maneuvering, and possibly catch him unaware. Even if you are detected, you have already gained the initiative.

Modern aircraft possess powerful radars which can detect aircraft at ranges exceeding 100 miles. Still, even at cruising speed, an enemy aircraft could cover that ground in a very short time. Early detection adds to your situational awareness and gives you the ability to keep the enemy at arm's length.

Once you have detected an enemy, either visually or on radar, keep him in sight. There's old fighter-pilot saying that goes, "**Lose sight- lose fight.**" If you lose sight of the enemy, you must start the detection process all over again. It may be too late. The enemy will have already started his pre-engagement maneuvering by the time you spot him again.

The simple fact of air combat from World War I to the present day, is that most pilots are shot down before they ever detect the enemy. Surprise is a key element of every engagement and usually deters the outcome of the battle. Stay alert.

In fighter slang, being "padlocked" means that you have visually spotted an enemy and are afraid to take your eyes off him. Aircraft are so small and travel so fast that if you look away for a moment, you might not spot him again.

To deal with this problem, aircraft controls and displays have been configured to limit the number of times a pilot must avert his eyes from a target. The Head-Up Display (HUD) superimposes visual flight cues directly in line with the pilot's field of vision. This keeps him from having to continually refocus his attention inside the cockpit to check his status.

In addition to the HUD, the "stick" has been redesigned to give the pilot fingertip control over the aircraft. The "Hands-On Throttle and Stick" or HOTAS design allows the pilot to perform common flight functions without having to take his hands off his principal means of controlling the aircraft.

2. CLOSURE

The second phase of air combat is known as Closure. During this phase, you are faced with a number of very basic decisions. After making a detection, you must first determine if the contact is hostile and then, whether it constitutes a threat to your mission.

This phase usually opens with one or both sides launching radar-guided missiles at targets detected at long range. The longer distances make radar-guided missiles more effective since it is easier to keep a target within the radar envelope. Depending on the effectiveness of the electronic counter-measures, radar-guided missiles will continue to track targets they are "locked onto." Survivors of this initial exchange proceed to the closure phase of battle.

Once you decide to engage the contact, you are committed. The objective in this phase of combat is to bridge the distance between yourself and your intended target. You must quickly figure out how to approach the target so as to arrive in a superior firing position. The most advantageous firing position is directly behind your target, known as being in his "six o' clock."

From this position the enemy pilot will have a difficult time shaking you off his tail. Not only can you follow him through his maneuvers but he will be unable to bring his weapons to bear on your aircraft. You must pay careful attention to your relative speeds. If you make a mistake and overshoot, the roles will be reversed. The enemy will now be in your "six" and fixin' to give you problems.

If the detection is made by radar you probably have already tipped your hand. The opposing pilot's RWR is likely to be activated by your radar sweep. However, just because the enemy is alert to your presence does not mean that he knows your exact bearing. If closure is performed properly, you may be able to arrive at a firing solution before he can locate you. To some extent, your maneuvering during closure will depend on what type of ordnance you are carrying.

Closure does not mean to imply being "close" to the enemy. Sometimes the closure phase ends when the aircraft are still many tens of miles apart. The missile age has pushed back the engagement envelope to beyond visual detection ranges. In a modern context, the closure phase ends when you are able to bring a weapon system to bear. Remember, that the enemy pilot will also be maneuvering to achieve the same thing and speed is essential to cut down on his reaction time.

As you and the enemy close, your aircraft will either have the advantage, be disadvantaged, or be neutral in relation to the opposing aircraft. Which of the three positions you find yourself in determines your action in the next phase of combat.

"A MiG at 'six' is better than no Mig at all."

3. ATTACK

The Attack portion of air combat is considered by many pilots to be merely the execution segment of the previous phase.

At the conclusion of the Closure phase, it should be easy to obtain a "kill" if you have reached an advantaged position. All that is left to do is select the proper ordnance, push the button, and avoid the debris.

Things are slightly different if you are in a disadvantaged position. It is imperative that you evade your opponent at the earliest opportunity and regain the superior position. As a minimum you should attempt to spoil your opponent's firing solution by performing one or more maneuvers discussed in the following segment.

If neither you or your opponent has achieved a superior position, the battle is momentarily a draw (neutral). Under these circumstances, the first pilot to make a mistake, loses the battle. There are few second chances in air combat, so don't be the one to make the first mistake.

4. MANEUVER

If a mistake is to be made, it is usually made here. The first pilot to pick a wrong maneuver or perform one incorrectly has given his opponent an edge. This phase of air combat is characterized by the twisting and turning battle often depicted in the movies. It is where pilots go head to head, performing Basic Fighter Maneuvers (BFM) in a effort to get a clear missile or gun shot.

This section is devoted to familiarizing the new pilot with Basic Fighter Maneuvers. In order to survive in combat, you must learn how to perform them correctly and be able to recognize them when an opponent tries them on you.

Your objective in this phase of combat is to position your aircraft in the opponent's "six o' clock" position. Once in his "six", your objective becomes staying in there until you have shot him down. Easier said, then done. Your opponent is trying his best to shake you off his tail and disengage. Given the opportunity, you can bet he'd love to get in a quick burst of gunfire of his own.

The g-forces involved in conducting BFM at a high rate of speed is a task multiplier. Flying at a constant rate of speed in level flight a pilot experiences only the normal effects of gravity or 1 g. But as a pilot enters a hard turn, he begins to be forced down into his seat as the effects of gravity become more pronounced. Simple things become difficult as your body assumes many times its own weight. Even moving his hands around the stick becomes tiring.

If a pilot continues to pull back on the stick, his turn becomes sharper but g-forces increase proportionately. The blood in his body starts pooling in his feet under the additional gravity. Unless he unloads the stick, the pilot may experience a g-induced blackout.

Bear this in mind as you blissfully perform all these wonderful maneuvers. Keep an eye on the HUD and make note of the g-forces you are imposing on yourself and the aircraft. While your F-15 can take nine-g's no sweat, to a human body it is quite a painful experience.

BREAK TURN

A Break turn is merely an abrupt change of direction made in response to an opponent's attack. It is usually made toward the enemy aircraft in an effort to spoil his aim or firing solution.

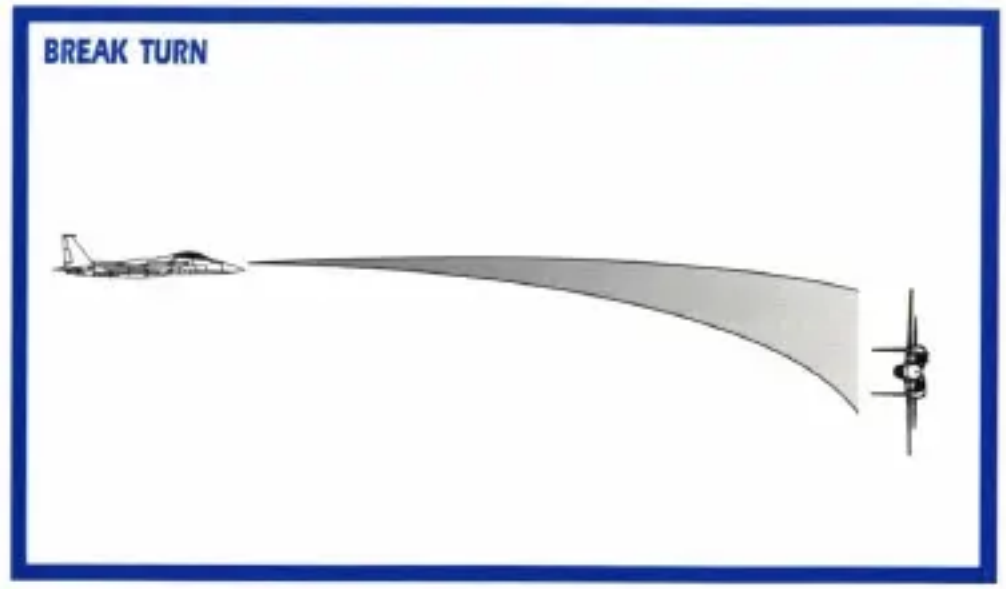
A Break is made at the maximum turn rate with wings inclined at 90 degrees. It is a high-g maneuver which if sustained leads to a rapid loss of airspeed. This may cause your opponent to overshoot, so be prepared to take advantage of his mistake.

Even if your opponent is able to stay on your tail, his "angle-off" perspective makes you a difficult target. If nothing else, a Break turn gives you time to recover from your initial surprise and start your own maneuvering. You cannot win air combat by remaining on the defensive. Use the Break turn to begin your offensive strategy.

EARLY TURN

If the closure battle for position has resulted in a stalemate, your opponent may decide to barrel straight in to bring on an engagement. The early turn maneuver is used to counter this head to head confrontation. As depicted in the diagram, it is a transitional maneuver used to get behind your opponent from a head-on aspect.

The trick to performing the early turn is to anticipate your opponent's future position in relation to your own. Inexperienced opponents usually fail to react to this maneuver in a timely fashion. They are soon caught in a turning battle they can't win.



LAG ROLL

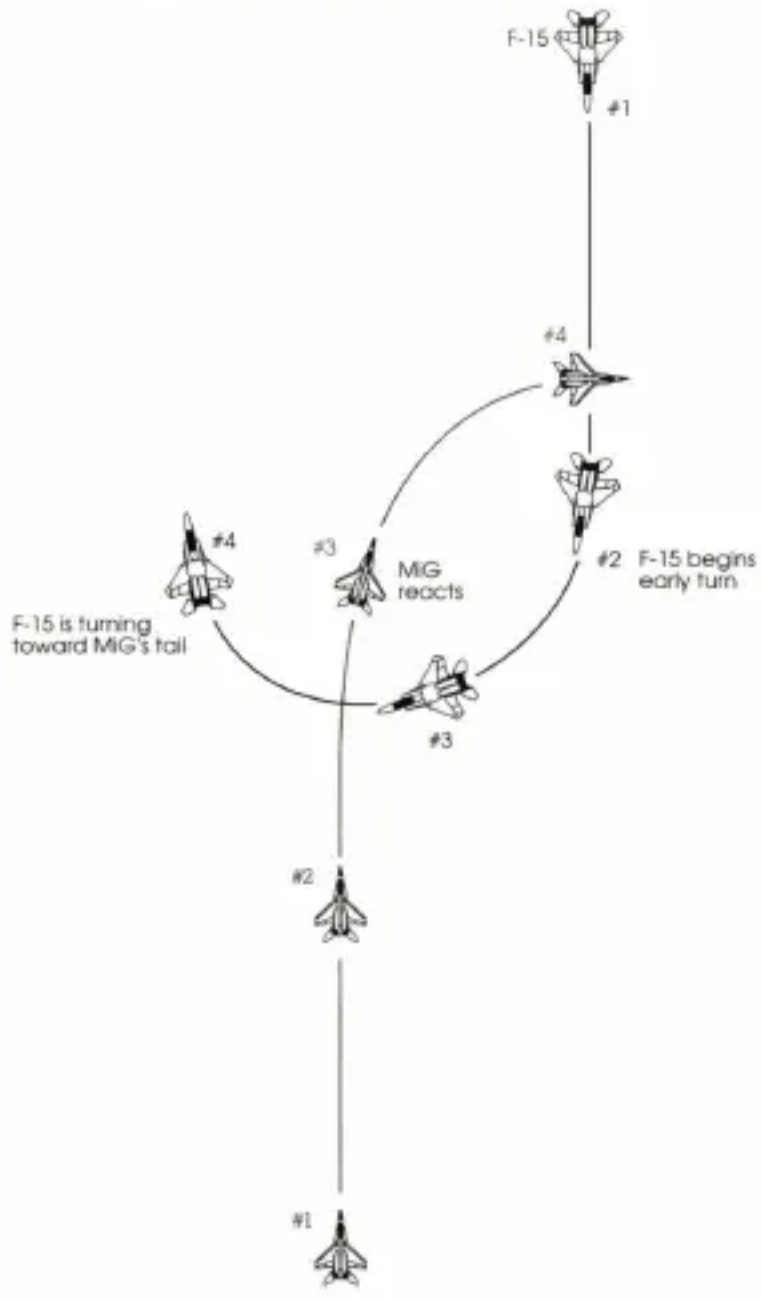
Another maneuver designed to cause an opponent to overshoot is the Lag Roll. The object of the maneuver is to quickly reduce your speed by increasing your aircraft's Drag.

Simply push the stick all the way over, left or right. Hold the stick in the direction of the roll while being careful to maintain the proper heading. If performed correctly, your opponent will be forced out in front of you. In this position, he's just dead meat. Add him to your collection.

SCISSORS

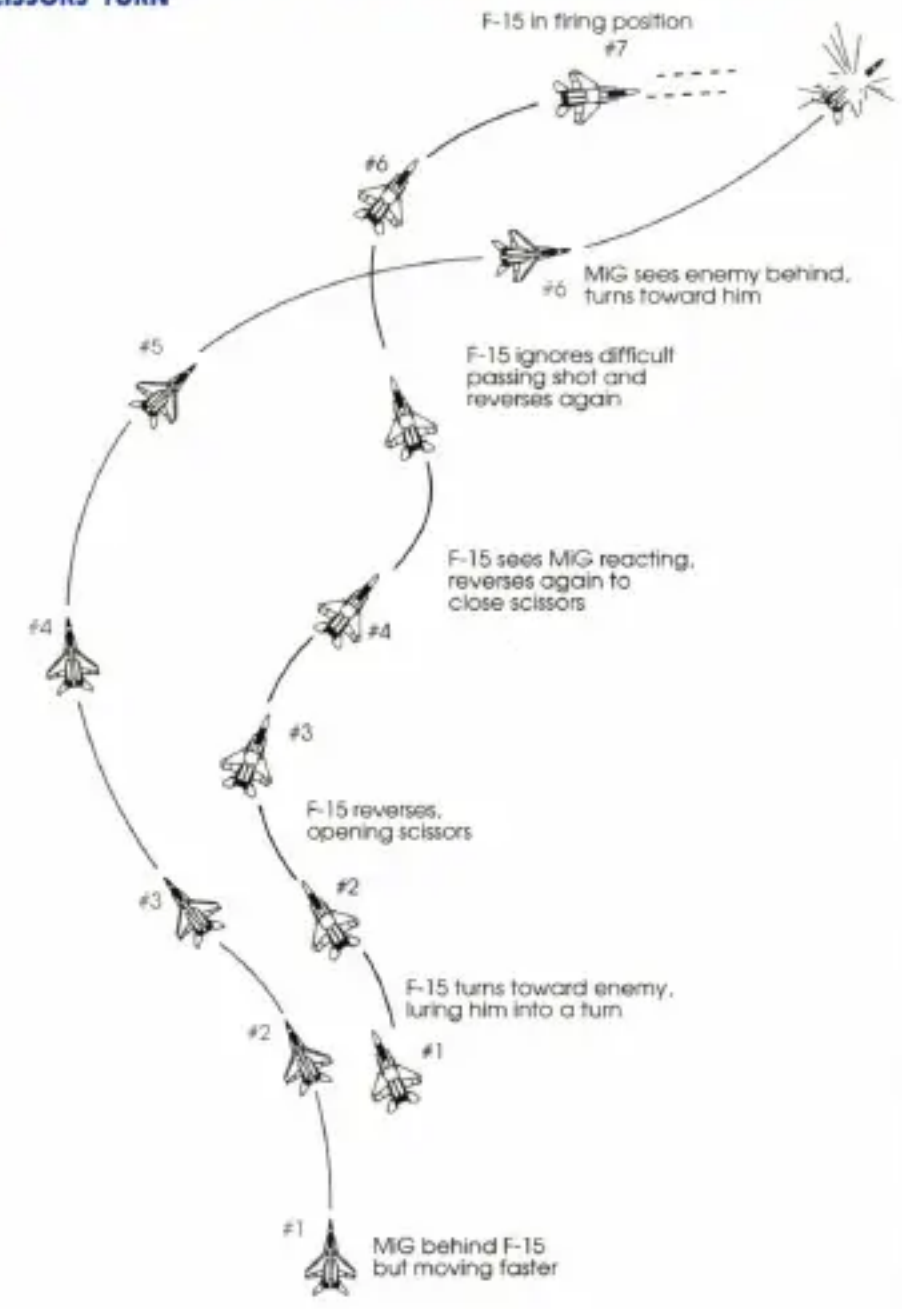
A Scissors maneuver is actually a series of turn and counter-turns in which the opposing aircraft are each attempting to get behind the other. This naturally causes both pilots to fly as slow as they dare in order to tighten their turns. Whichever pilot forces the other to take the lead in this type of battle comes out the winner. Speed brakes and flaps help to slow you down but caution must be used to prevent an accidental stall.

EARLY TURN ON A HEAD-TO-HEAD PASS

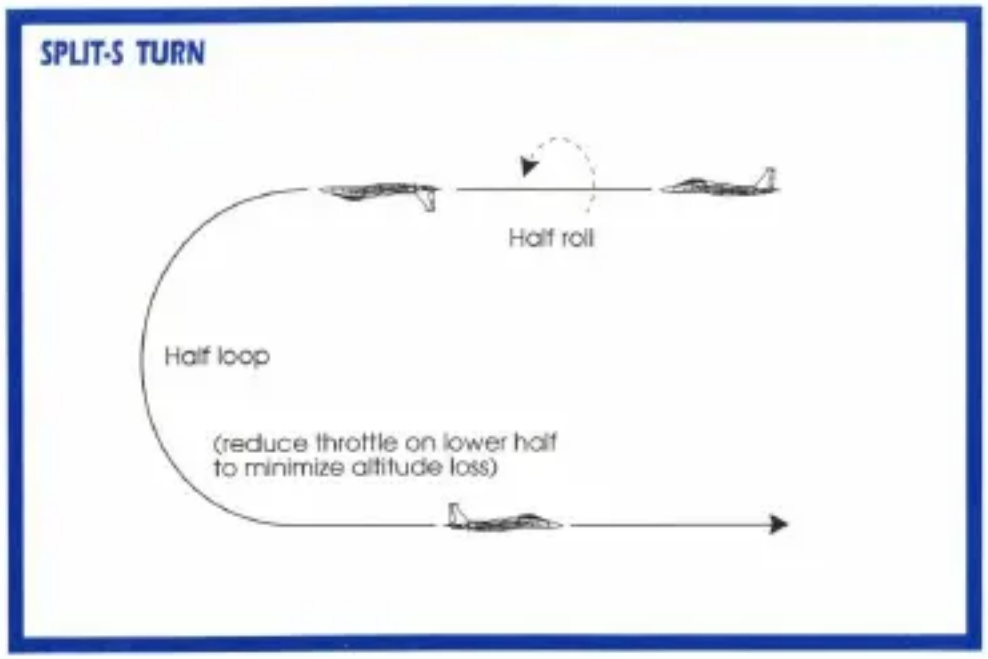


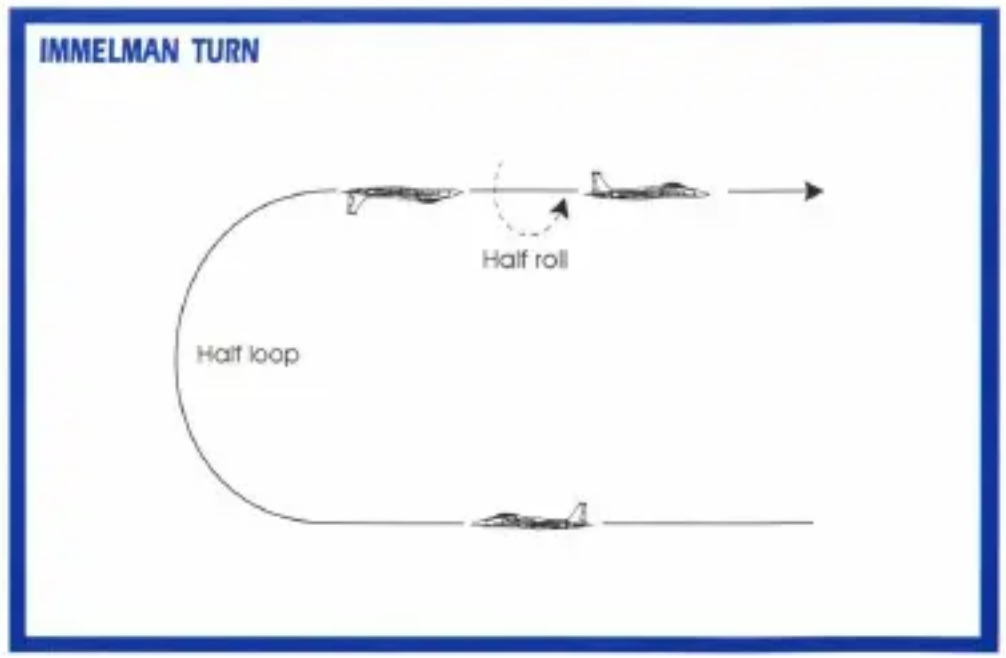
If both pilots are equally experienced, the scissors maneuver usually ends in a draw. As airspeed continues to drop, the hard turning involved may easily lead to a stall situation. Before that happens, disengage from the scissors and reposition yourself.

SCISSORS TURN



Disengaging from a scissors battle takes careful timing. Wait until you are pointing away from your opponent in an outward turn, roll inverted and dive away to increase the separation distance. Your opponent's airspeed will be low as well, giving you time to escape.





SPLIT-S

The Split-S is a reversal maneuver combining a half-roll and dive to increase speed. It is a quick way of changing your direction 180 degrees and is usually begun from level flight or slight climb.

To perform a Split-S, simply roll inverted. Once inverted, pull sharply back on the stick to enter a dive. This maneuver causes you to lose considerable altitude so make sure you have room *before* attempting a Split-S.

As you enter the dive, punch the throttle and go to afterburner if your airspeed is under 350 knots. You are now travelling 180 degrees from your original heading with a reservoir of stored energy. Use this energy to disengage or reposition yourself for a missile shot.

IMMELMANN TURN

The Immelmann turn is named after its inventor, Max Immelmann, a German World War I ace. It is the exact inverse of the Split-S. Whereas the Split-S is performed as a dive maneuver, the Immelmann is a climbing half-loop used to get on the tail of an enemy coming head-on.

Speed is the critical factor in performing an Immelmann turn. Before attempting an Immelmann, check your air speed to insure that your aircraft has the energy to complete the maneuver without stalling.

An Immelmann is best performed when begun from level flight or a slight nose-down attitude. Simply pull back on the stick, applying pressure until you reach the vertical plane. As your air speed continues to drop off, you must judge for yourself when to complete the maneuver before stalling.

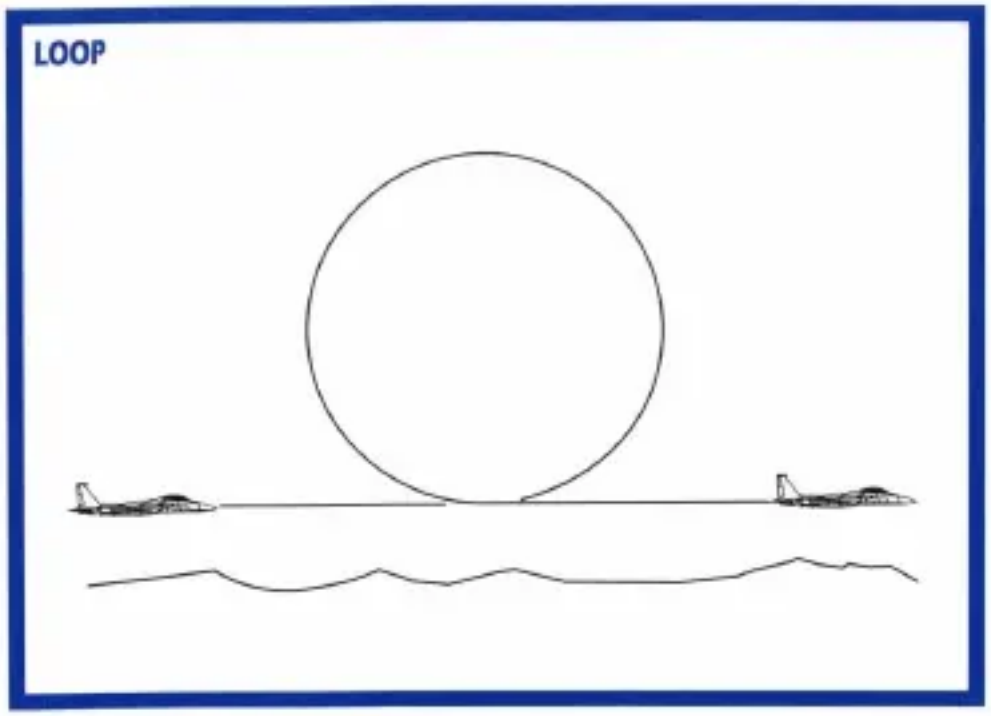
The Immelmann is completed by pulling through the maneuver back into level but *inverted* flight. Once in level flight, a simple half-roll returns you to a normal flight profile.

LOOP

By now you undoubtedly have noticed that a Loop is nothing more than combining a Split-S with an Immelmann, or vice versa. Loops are performed to avoid an enemy in your six o' clock while trying to aim your guns at his tail at the same time.

Either half of the maneuver can be performed first depending on the circumstances. If you are traveling fast and wish to slow down, pull into an Immelmann. Continue to apply constant back pressure while reducing your throttle. Once the nose comes over the top, your speed increases as you come down the back side of the Split-S. Add or subtract power as needed.

Start your Loop with a Split-S if you do not have enough energy to perform an Immelmann immediately. Depending on how much altitude



you wish to lose, keep your throttle open. This provides you with additional energy for when you pull into your climb. Note that you end up flying inverted along your original heading.

STRAIGHT PURSUIT YO-YO

A Straight Pursuit Yo-Yo is used when pursuing an enemy trying desperately to disengage from combat. For example, an opponent has caught you off-guard with a sudden Split-S and is rapidly leaving the battle area. You turn to pursue and find him well below and far in front.

To close the distance, you dive down until you reach the opponent's altitude. If you are still unable to close within weapon's range the Yo-Yo maneuver is used to trade altitude for air speed. Simply enter a shallow dive, until you gradually begin to overtake him. When in range, pull the aircraft's nose up to engage. This maneuver is repeated as often as is necessary.

5. DISENGAGEMENT

Disengagement is a critical part of air combat. The best way to disengage from combat is to shoot down your opponent. If this seems unlikely, maybe it's time to start thinking how you are going to get away.

Given the reach of modern air-to-air missiles, getting out of combat is much more difficult than getting in. You must figure out a method of putting some distance between you and the enemy before he realizes what you are up to. It requires careful timing to avoid being shot down while trying to get away.

If your opponent is not equipped to carry missiles (or has run out), the job of disengaging is much easier. All you need do is maintain a lateral separation which exceeds the range of his guns. If he gets in your "six" and wants to follow you home, fine.

A missile equipped opponent has a much longer reach. Even if your disengagement is successful, chances are your opponent will get at least a parting missile shot. There's no way to prevent this launch although ECM and skillful maneuvering may keep it from hitting you.

If you have managed your fuel properly you can afford to use a little afterburner for extra speed. Hopefully your opponent has been less careful with his fuel and must weigh his chances of getting home should he prolong his pursuit.

CANNON/GUN COMBAT

At the beginning of the Vietnam era, certain USAF fighters went to war without a cannon or gun. Believing that the missile age heralded a new era in air combat, theorists considered a gun unnecessary. To destroy an opponent, a pilot needed only to detect a target on his radar, select one of a number of missile options and push a button.

Theorists were quick to point out that guns were useless except at very close range and that the speed of modern aircraft made close engagements unlikely. Furthermore, enemy aircraft were to be kept at missile range and destroyed beyond visual range (BVR). Pilots were told not to expect the type of twisting and turning "fur-ball" engagements which were a common occurrence during Korea. The Vietnam War proved the theorists wrong.

The use of gunfire in air combat has not changed since World War I. It is still a matter of maneuvering in close to your enemy and then pumping lead into his aircraft until it goes down. The trick is to obtain a good firing position from where the enemy can not return your fire. This generally means that most strafing attacks occur when one aircraft gets in the six o'clock arc of another.

Firing from an position not directly in line with the target's flight path is known as an "angle-off" or deflection shot. Firing from an angle-off position gives you less time to line up the shot and requires you to lead the target. The best firing method for a deflection shot is to put up a wall of lead and let the enemy fly into.

In 1969, the original F-15 contract called for the development of a pure air superiority fighter. There was never any intention of building a secondary capability into the design. The McDonnell-Douglas engineers went by the motto, "... not a pound for air to ground." In other words, no feature of the aircraft was to be used for anything other than dogfighting.

But the F-15 proved to be such a versatile machine that continuing to neglect its air to ground potential was deemed a waste of a good design. Over 30% of the aircraft was completely re-engineered to accommodate air-to-ground missions. With the addition of sophisticated targeting equipment and dedicated back-seater, a dual role capability was built into the basic fighter design.

MISSILE COMBAT

There are two types of air-to-air missiles carried by modern aircraft, **radar-guided** and **heat-seeking** missiles. It is important to remember that each type of missile has its own unique set of advantages as well as limitations.

RADAR-GUIDED MISSILES

Radar-guided missiles come in three basic categories; beam riders, semi-active radar-homers, and active homers. The first two categories require the firing aircraft to maintain a radar "lock" on the target aircraft. This means the firing aircraft is essentially stuck with having to track the target aircraft while the missile is in flight.

Beam-riding missiles are surface to air missiles launched from either fixed sites or mobile launchers. The missile follows the path of a laser beam directed from the launching site at the target aircraft. The beam must be held on the target throughout the missile's flight to insure a hit.

Semi-active radar missiles require the target to be continually illuminated by the firing aircraft's radar. The missile then guides itself by using the reflected radar energy it detects coming off the target.

Active homing missiles transmit and receive their own radar signals allowing them to track a target without help from the firing aircraft. These are the most deadly. To the firing aircraft, active-homers are "fire and forget". After they are launched the firing aircraft is free to continue maneuvering.

INFRARED MISSILES (HEAT-SEEKERS)

Infrared missiles use heat as the source of their guidance rather than radar signals. These missiles also are "fire and forget" but generally have shorter ranges than their radar-guided cousins. Heat-seeking missiles operate by homing in on the greatest source of heat within their seeker's cone of detection.

These missiles must be used with care during a general engagement because they are just as likely to home in on friendly aircraft as enemy. The early models were often fooled by active counter-measures such as flares. Some missiles could even be decoyed by the Sun or glare off the tops of clouds.

To obtain the greatest assurance of a hit, heat-seekers must be aimed at the hot exhaust area of a target. On later models, the IR sensitivity has been increased to allow the missile to track a target from any aspect. These missiles are less easily fooled by ECM.

DEALING WITH MISSILE ATTACKS

The primary way of dealing with missile attacks is to avoid them. Your pre-flight briefing covers the location of known or suspected SAM locations. If you have paid close attention you can plan your route of ingress around them.

Sometimes the target is so heavily defended (like Baghdad), it is impossible to plan a flight without encountering a few SAM sites. Make careful note of the locations and types of SAMs you are unable to by-pass.

An audio signal is usually your first warning that a missile has been fired. Once you receive this cue, it's time to start carrying out your plan of action. You have two choices, evasive maneuvering or the use of ECM.

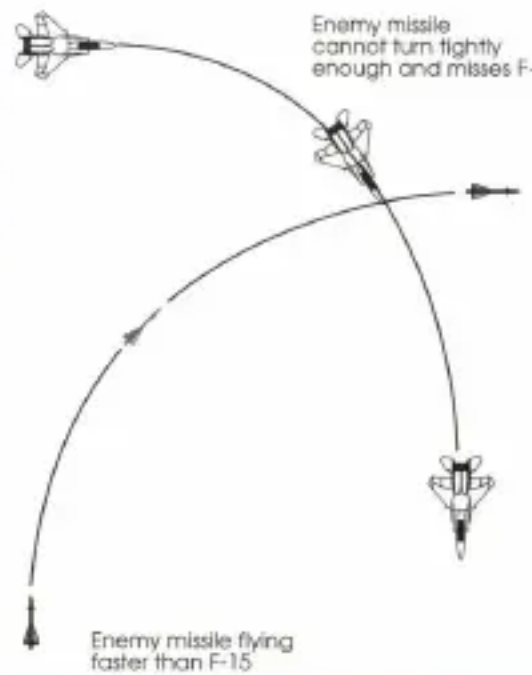
EVASIVE MANEUVERING

When it comes to flying, the same rules apply as when driving the family car. You must fly defensively, watch out for the other guy, and expect the unexpected. Defensive flying is what Situation Awareness is all about. If you are not aware of what is going on, you can hardly be expected to react to it.

TURNING INSIDE A MISSILE

The F-15 turns so tightly the missile can't stay with it and passes harmlessly to the right. This is a good maneuver for avoiding IR-homing missiles.

TURNING TOWARD A MISSILE



The F-15 is evading a missile using its maneuver power alone. As the Eagle turns, the missile tries to follow, but cannot turn fast enough. The missile "falls behind" and passes harmlessly to the rear.

Despite being totally aware of your surroundings and best defensive flying efforts, the enemy will eventually get a shot off. Once the warning lights start going off in your cockpit, it is too late to devise a strategy. You must fly with a plan already in mind.

The Basic Fighter Maneuvers (BFM) described for use in dogfighting can also be used to defeat enemy missiles. The job is somewhat more difficult because a missile is faster and can perform without regard for a human pilot. But at the same time, missiles only have to be fooled once before going ballistic.

TURNING INSIDE A MISSILE:

When a missile is closing in on your F-15, keep your head and don't panic. Because the missile's turning arc is wider than your aircraft's, you still have a chance to outmaneuver it.

If a missile is approaching from the rear you can perform a high -g turn hoping to get inside its turning radius. It is best to wait until the last moment before starting your Break. If you try this turn too early, the missile may still turn into you.

TURNING TOWARD A MISSILE:

If a missile is approaching from more of a side angle, turning toward it may also get inside its turn radius. As depicted in the diagram, your turn must keep the missile's flight path at a right angles to your own. Gradually, the missile will fall into a lag pursuit profile and pass well behind you.

EVADING HEAD-ON MISSILES:

Evading a missile which is approaching from a Head-on position is a two-step procedure. First, when the missile reaches a point between 8 and 12 kilometers away, perform a 90 degree Break turn. The missile's flight path is now perpendicular to your heading. Step two is simply following the procedure under turning toward a missile.

III. ELECTRONIC COUNTER-MEASURES

Electronic Counter-Measures come in two basic types, those designed to fool radar-guided missiles and those used against heat-seekers. It is important to identify the type of missile tracking your aircraft in order to deploy the appropriate counter-measure.

CHAFF

Chaff is stored within the aircraft in (CMDs) Counter-Measure Dispensers located directly underneath the main engine intakes. It is used to defend your aircraft against radar-guided missiles by releasing a cloud of metal strips cut to a particular wave-length. The strips serve to confuse the enemy radar by cluttering the image with many false returns.

The classic technique for deploying chaff is to release a bundle as soon as your RWR alarms. With luck, the chaff has a chance of breaking the contact. If the missile continues to guide, wait to deploy additional chaff until the missile is within three to five kilometers. Since your supply of chaff is limited you must use it judiciously.

Once the missile "locks-on" to the chaff, it will fly into the cloud and explode on contact. The trick is to deploy the chaff at just the right moment. If deployed too early the missile will not be fooled. If deployed too late, it won't do any good.

FLARES

For defense against IR homing (heat-seeking) missiles, the F-15 is equipped with a number of heat producing devices, commonly known as Flares. Flares are used to decoy heat-seeking missiles away from your aircraft. Like chaff, your aircraft carries only a finite supply of these Flares.

A Flare burns for only a short time (5-10 seconds). During this time, the IR missile hopefully is lured away from your aircraft. Once the Flare burns out, however, the missile is free to re-acquire a new target. The new target may again be your aircraft if you have not maneuvered out of its view.

It is never a good idea to trust ECM entirely. It is always better to have an evasive maneuver ready in case it fails. It is far more reliable (and cheaper) to physically evade a missile, rather than try to confuse it with ECM.

TEWS

The F-15 features a specially designed ECM system known as the Tactical Electronic Warfare System (TEWS). It consists of two main components; the AN/ALR-56 RWR and the AN/ALQ-135(V) radar jammer. These systems, described in greater detail in Chapter 1, detect the presence of both ground-based and aerial radars. The primary job of the TEWS is to provide you with prompt radar warnings, giving you ample time to deal with the threat.

The TEWS is a completely hands-off internal system. The AN/ALR-56 RWR detects the radar and gives audio signals when an enemy is attempting to gain a radar "lock" on your aircraft. The AN/ALQ-135(V) is an internal jammer which functions automatically to defeat the hostile radar's acquisition. The pilot, who must first activate the jammer, is then free to maneuver or deploy chaff to further confuse his aircraft's radar signature.

IV. GROUND ATTACK MISSIONS

PRE-FLIGHT BRIEFING

The most important part of any mission takes place before the pilots ever leave the ground. The pre-flight briefing is the last chance for all the members of a particular package to get together and discuss tactics, coordination, etc. Mission details are laid out at this time to sort out any lingering confusion.

Smart pilots use this time wisely. They know it's always better to be on the ground wishing they were in the air, than already in the air wishing they were on the ground. Once in the air, its too late to start sorting out details.

THE FLIGHT PROFILE

One of the first things to get settled during the briefing is the flight profile. In other words, pilots need to figure out how they intend to fly from their base, attack the target, and then return home. A number of factors go into this decision such as weather, range to target, enemy disposition and equipment, etc. Flight profiles are usually broken down into three mission segments, ingress, target, egress. Altitudes are assigned to each of these segments accordingly.

A Flight profile might read Hi-Lo-Hi. In this instance, strike aircraft are proceeding to the target up high to conserve fuel. Upon reaching their Ingress Point (IP), the package drops down low for their target run. After striking the target, they climb to a pre-set high altitude for the return trip home.

Based on the flight profile, certain assumptions can be made regarding the mission. Because the ingress is being conducted at high altitude the package is apparently not concerned about being spotted. Air superiority has either been achieved or the SAM threat is negligible. The target is probably heavily defended by triple-A so the attacking aircraft drop down to use the terrain for cover. On the way out, the formation again takes advantage of high altitude fuel conservation so it is likely that the target is some distance away.

If the flight profile had been Lo-Lo-Lo, the target is likely to be close by and heavily defended by both point and area air defense weapons. Lo-Lo-Lo missions require the package to fly low to the ground to avoid detection or enemy air patrols. While a low flight profile protects against SAMs, it exposes the aircraft to all kinds of triple-A ground fire. These are the tough missions. The combination of high speed and low altitude leaves no margin for error.

SURVEYING THE TARGET

The target should be thoroughly researched and surveyed prior to the mission. Photo-intelligence from satellites or even RF-4 Phantoms should be disseminated at this time so that the pilots have an accurate picture of the target.

Once in flight, the next opportunity the attacking aircraft have to survey the target is by LANTIRN. The system's displays provide the Wizzo with photo-quality, high-resolution images. Even if flying a Lo profile, the FLIR's "squint" angle is such that ground features are distinguishable even from a distance.

A last minute survey is necessary to insure that the attacking aircraft are properly aligned with the target. The target run should be performed at high speed to minimize exposure to hostile fire. Locating the target(s) early gives the Wizzo extra time to select and deploy his weapons.

ORDNANCE OPTIONS

The target run and weapons release is dictated to some extent by the type of ordnance carried. "Fire and Forget" weapons, like the AGM-65 Maverick missile, allow the aircraft to stand-off at a safe distance from the target. Other "smart" weapons require guidance from the aircraft's LANTIRN system and a direct line of sight to the target.

The most difficult type of ordnance to release are still the unguided iron bombs or "dumb bombs." These weapons have changed little since World War II. They still require that the attacking aircraft overfly the target

area. Modern aircraft, however, are not locked in to the straight and level bomb runs of the past. A good pilot develops special techniques using both terrain and maneuver to get in close and drop his unguided munitions.

TARGET APPROACH OPTIONS

DIVE BOMBING

The easiest target approach is the time-honored Dive Bombing technique. Dive bombing requires the target run to begin at medium altitude between 6-12,000 feet. Because the aircraft has built up excess speed during the ingress, speed brakes must be applied before transitioning into the dive.

Once the aircraft is properly aligned on the target, nose over into a 30 degree down angle. In the few seconds you have while in the dive, make any final targeting corrections and release the ordnance. The release should be performed at around 3,000 feet.

You must allow yourself time to escape the blast effects of your ordnance. Immediately retract your speed brake, open the throttle and exit the area. Pilots which damage their aircraft with their own bombs should perhaps consider a new career. If they make it back to base, they have some explaining to do at the very least.

POP-UP BOMBING

Another method of unguided delivery is the Pop-Up. This technique is more difficult than the simple dive bomb method but exposes the attacking aircraft to less triple-A. It takes careful timing and good spatial perception (Situational Awareness). If you are not used to working in three dimensions, stick to dive bombing and take your chances with enemy ground fire. Pop-Up bombing is very unforgiving if you make a mistake.

The idea behind Pop-Up bombing is to approach the target at a very low altitude. At the last minute the aircraft is pulled into an inverted climb to identify and pin point the target. Once the target is identified, the aircraft noses over into a dive, half rolls, then delivers ordnance normally. The egress is usually performed at low altitude.

The biggest danger in performing a Pop-Up maneuver is misjudging altitude and being unable to pull up in time. The margin for error is very narrow. Rather than pressing your luck, it is better to go around. By now they know you're coming. So change your approach heading and strike from an unexpected direction.

This attack option, if performed correctly the first time, gives the enemy no time to react. You are exiting the area unscathed just as the first bombs begin going off. It takes practise to perfect the Pop-Up but it is well worth the effort.

LEVEL BOMBING

Level bombing is perhaps the most dangerous of all your available options. You are trading predictability for heightened bombing accuracy. However, deploying stand-off weapons such as the Maverick missile or various glide bombs, lets you keep a safe distance away from the target's fixed air defenses.

In actual practice, level bombing has changed very little since World War II. Although massed bomber formations are a thing of the past, level bombing still involves a steady run-up to the target. Approach speeds have greatly increased but advances in radar-controlled triple-A technology have made this method of bombing extremely risky. It is seldom used if other means of delivery are available.

The target approach should be conducted as low as the surrounding terrain permits, preferably 300 feet or less. Because the mapping radar is unable to generate HRMs at such a low altitude, pilots are required to expose their aircraft to enemy radar coverage while designating targets. The course should be off-set at least 25° from the target's bearing while producing targeting maps. This cuts down on the delay time in processing the map image.

Once the target is designated, turn to the proper target bearing and assume your delivery altitude. Engage your afterburner to minimize your exposure time over the target defenses. With ranged "smart" weapons, you may launch the ordnance from a safe stand-off distance. Iron bombs (unguided) require that you overfly the target. If this is the case, deliver your ordnance fast and "get out of Dodge."

EGRESS

The last important consideration is the egress, or exit from the target area. To a great extent, your exit is pre-determined by the enemy disposition. If the target is heavily defended, remaining low may be your only safe option. But against less well defended targets, you may decide to regain cruising altitude soon after leaving the area.

This is usually a good time to hit your afterburner if your fuel status allows it. You should be concentrating on putting as much distance between you and the target area as possible. Even though the ordnance has been released, the mission is far from over.

Begin checking the general condition of your aircraft for possible damage from ground fire. Be sure to scan your instrumentation for abnormal readings and prepare for the long ride home.

Hans Halberstadt/Arms Communication

4. THEATER SCENARIOS

I. IRAQ: DESERT STORM

"In just 100 hours, they went from the fourth largest army in the world to the second largest army in Iraq."
— Lt. General Thomas W. Kelly

THE IRAN-IRAQ WAR

Throughout the 1980s, Iraq fought a bloody, stagnant war of attrition with the Islamic Republic of Iran. While the war was characterized by heavy ground fighting, air power was used infrequently and never to any great effect. With the exception of a number of air strikes against economic targets (oil facilities and tanker traffic in the Gulf), sorties were relatively few and far between.

The Iranian Air Force consisted primarily of U.S. aircraft that had been purchased by the Shah before his overthrow. Despite possessing some of the most capable and advanced aircraft in the world, the Iranian air force spent the majority of the war grounded for lack of spare parts. Iran had started the war with hundreds of modern U.S. fighter-bombers including F-14s Tomcats and F-4 Phantoms. The inventory quickly dwindled as aircraft were cannibalized for spares. By the end of the war, Iran was lucky to have 80 aircraft combat ready at any one time.

IRAQI STRATEGIC AIR DEFENSE

Iraq had eight years to construct a national air defense capable of dealing with the Iranian threat. A centralized system was developed which reflected the doctrinal preference of Iraq's chief military benefactor, the Soviet Union. While the system worked reasonably well against Iran (which wasn't doing that much flying), it was hardly suited to conditions that might be imposed by a more determined opponent.

The Iraqi air defense scheme sectioned the country into four zones, each responsible for its own airspace. While these zones were independent of each other, all four were tied to a central air defense ministry located in downtown Baghdad. Intermediate radar control centers in the chain were located in major cities such as Kirkuk, Nasiriya, and Rutba, among others. Ground Control Intercept radars (GCIs) were dispersed throughout the country to complete the lower echelon network.

One factor aided the Coalition's air campaign immensely. Most Iraqi air defense headquarters and communications facilities were constructed above ground. Since Saddam Hussein had initially come to power in a coup backed by the military, he was always on guard against being overthrown in a counter-coup. Hussein was therefore reluctant to position his command centers out of easy reach should he be forced to attack disloyal members of his own army. Being stationary above-ground targets made them easy prey for Coalition aircraft.

Tall King low frequency radars provided Iraq with an umbrella-like coverage although they frequently were out of action with maintenance problems. When operational they gave Iraq the ability to detect high altitude targets at ranges in excess of 500 kilometers. For coverage at lower altitudes, fast scanning *Squat Eye* radars were used. Iraqi interceptors relied on ground guidance from *Bar Lock* radar systems which gave both height and range information. This interlocking system of coverage and command is preferred by the Soviet Union and is designed to closely tether its interceptors to ground controllers. In military circles, this type of interlocking defense is referred to as an **Integrated Air Defense System** (IADS).

THE INTEGRATED AIR DEFENSE SYSTEM

The operational principal behind IADS is that all facets of a nation's air defense (interceptors, SAMs and triple-A sites) can be coordinated and combined as part of a total defense plan. Crucial to the success of this type of air defense plan is the ability to communicate with the component parts. Each element must be able to communicate instructions as well as receive guidance from higher up the chain of command. Failure to maintain communications is the "Achilles'" heel in such a system.

Ideally, an IADS is constructed in such a manner as to provide overlapping and layered coverage. For example, long range, high altitude SAMs would provide blanket coverage to the entire nation while being protected by shorter range SAMs suited for low altitude engagements. Triple-A sites would be tactically positioned near high value targets such as industrial plants or airbases. Fighter aircraft would be redeployed to dispersal fields and used to fill gaps in SAM coverage.

Once again, communication is the key. Interceptors must remain linked to a network of ground radars for guidance. SAM sites must alerted if friendly aircraft are operating inside their engagement envelope to avoid accidental downings. Finally, communication between the various radar installations and higher command authorities is vital since detections must be passed on before appropriate targeting orders can be disseminated.

In theory this system works fine unless it becomes overloaded, something which did not happen during the Iran-Iraq war. Once too many things start happening simultaneously, a centralized system loses its ability to deal with individual threats. This type of system has a built in resiliency and can withstand a fair amount of body blows. However, only one blow to the head is needed to paralyzed the entire system. Knocking out the central command authority essentially isolates the component parts making them susceptible to systematic destruction.

Iraqi air defenses were about to be put to the ultimate test. Saddam Hussein, by invading the tiny kingdom of Kuwait in 1990, unleased the most sophisticated aerial armada ever assembled. A coalition of over thirty nations gathered under United Nations' auspices to oppose this blatant case of Iraqi aggression.When the air war over Iraq began on 17 January 1991, a knock out blow was exactly what the Coalition strategists had in mind.

SSG Jim Gomez, U.S. Army

OPERATION DESERT SHIELD

So overwhelming were the assembled Iraqi forces, the conquest of Kuwait basically took an afternoon. By halting his army at the Kuwait's southern border with Saudi Arabia, Hussein committed his first and perhaps greatest strategic blunder of the war. Had he continued into Saudi Arabia,

a major U.S. deployment into the region may well have proved impossible. Without bases in Saudi Arabia, the Coalition would have been hard pressed to find a suitable staging area for its build up.

In a secluded basement wing of the Pentagon, the most respected members of our military establishment met in the late 1980s to discuss contemporary aspects of the Air-Land Battle doctrine. Designed to meet NATO's operational needs in western Europe, the tactical concepts were being studied for their relevance in potential Third World hot spots. The officers taking part in this super-secret think tank were referred to as the *Jedi Knights*.

The Air Force contingent of this interservice round table was known as *Project Checkmate*. Checkmate's job was to prepare a deployment and logistics study to support a major air effort in the Persian Gulf. This hypothetical campaign plan was given the numerical designation 1002-90. "Ten-Oh-Two" called for deployment of F-15Es to the Gulf on the first day of the operation. Heavy ground forces would need at least thirty days to deploy and until they arrived the F-15s would have to hold the line. When the invasion of Kuwait became a reality in August 1990, it was a simple matter for the Jedi Knights to dig up 1002-90.

Initially the overall strategy was merely defensive, a measured response designed to deter Iraq from invading the weak Gulf states on the Arabian peninsula. Now, with Hussein's forces digging in at the Kuwaiti border, the strategy was shifting to a more offensive stance. If economic sanctions and strategic bombing were not persuasive enough, Hussein's forces would have to be ejected from Kuwait by a ground campaign. Should that become necessary, air power had to be on hand to minimize Coalition casualties.

F-15E squadrons from the 4th Fighter Wing based at Seymour-Johnson Air Force Base, North Carolina, began their deployment as scripted in 1002-90. Fresh from their victory in the Air Force's Long Rifle competition, these squadrons made the flight to Tabuk, Saudi Arabia in 14 hours. Eventually all F-15Es would wind up at Al Kharg airbase, south of Riyadh. Affectionately known as *Al's Garage*, this brand new facility was comparable if not better than what they had left behind.

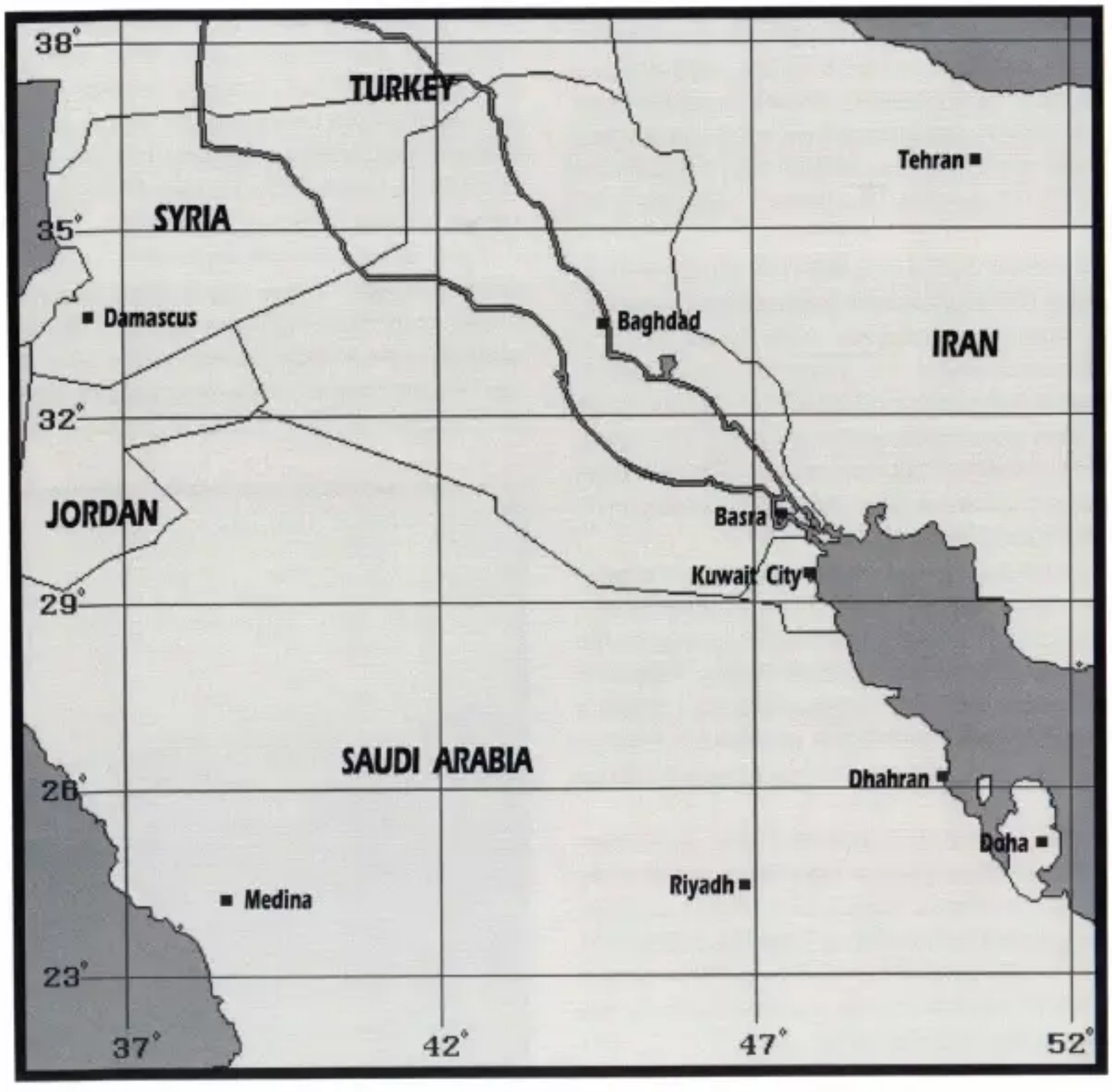
"INSTANT THUNDER"

The air campaign (*Instant Thunder*) revolved around a single list of targets, or Air Tasking Order (ATO). The ATO is similar in many respects to a football team whose playbook for the entire season must be laid out in advance. When conducting a major air operation such as Instant Thunder, assembling the plays can become a Herculean task. The first several days of the operation, for example, required an ATO over 300 pages in length. As the air war progressed, a 300 page ATO would become required on average for every 24 hours of air operations.

Architect of Instant Thunder's ATO was Lt. General Charles "Chuck" Horner. Gen. Horner had been appointed by Gen. Norman Schwarzkopf to head up the Coalition's unified air forces. Assisting him in targeting assignments was Brigadier General Buster C. Glosson. Glosson and his team of professional targeteers (*fraggers*) had the responsibility of developing a systematic approach to the air campaign. These men, along with

SSG Jim Gomez, U.S. Army

THEATER MAP – DESERT STORM



their staffs, occupied a hastily refurbished storage area in the Royal Saudi Air Force Headquarters off Abdul Aziz Boulevard in Riyadh.

Within walking distance of the RSAF complex was a soccer field belonging to the U.S. Military Training Mission. Located on this playing field were a number of pre-fab buildings. Inside one of these was a confined work area made up of eight cubicles underneath a 15x30 foot tent. It was from this spartan work station, known as the "*Black Hole*" that all the targeting data for Instant Thunder would be assimilated and processed.

Targets were initially gathered by "national technical means" a now familiar euphemism for satellite intelligence. Once these targets were defined and passed on to the Black Hole, the ATO prioritized them in a proper sequence. Specific aircraft and ordnance could then be assigned by Horner's fraggers to eliminate each target in a predetermined manner. This aerial ballet was choreographed to make the most out of each aircraft and its weapon systems.

Instant Thunder was designed with specific campaign objectives in mind. Obviously not all targets in the Kuwaiti Theater of Operations (KTO) could be hit simultaneously, so priorities were established which grouped similar targets into campaign phases. Each of these phases were designed to compliment each other as the campaign progressed. In this manner subsequent phases could build on the success of the preceding strikes.

OPERATION DESERT STORM

On 17 January 1991 at approximately 0045 hours, F-15Es belonging to the 4th TFW and over a hundred other tactical aircraft were flushed from Al's Garage. Less than two hours later, strategic bombing of Iraq commenced. Operation Desert Shield had turned into a *Desert Storm*. Over 1,400 sorties were staged over Iraq in the first twenty-four hours of the war. For the next forty days and forty nights, Iraq would be exposed to a biblical torrent of bombs, rockets, and missiles.

INSTANT THUNDER PHASE 1

The first phase of the air campaign required the Coalition to disrupt Iraq's air defense system by knocking out communication facilities. The radar "eyes" of the network would also be struck in the first wave so subsequent strikes could go undetected.

Certain GCIs, especially in the western desert, were particularly important. Even before the first raids began, Special Forces teams were inserted by MH-53J Pave Low helicopters to assist air attacks from the ground. These teams designated targets using hand held lasers. Apache AH-64s and A-10 Thunderbolts destroyed the radar sites and opened up detection-free corridors into Iraq's interior.

Of course, the F-117 Nighthawk Stealth fighters needed no such corridor. These aircraft apparently worked as advertised although there were at least two recorded incidents of ground radar detection, one Iraqi and one British. Even so, F-117s performed the difficult missions over Baghdad without a single loss.

High priority Command, Control, Communication and Intelligence (C^3I) targets in Baghdad were struck at the outset with precision guided munitions (PGMs). Later, the media would receive videotape footage taken from the initial strike. One scene showed a 2,000 lb. GBU-27 being guided down a ventilation shaft in Iraq's Air Defense Ministry. Courtesy of the stranded CNN reporters in Baghdad Al Rashid Hotel, the world got a play-by-play account of the first night's raid over the capitol.

Although Saddam Hussein was not directly targeted per se, as the commander of Iraq's military forces he was obviously part of its C^3I that the Coalition wished to disrupt. As a general rule it is never necessary to specifically target the leadership as individuals. But, if the leadership can be prevented from communicating with its forces, the net effect is the same. In this first phase, likely command centers were targeted. If Hussein happened to be caught in one, so be it.

Tomahawk cruise missiles or Tactical Land Attack Missile-C (TLAM) were fired from Navy vessels, including the submerged Los Angeles class submarine, the *USS Louisville*. These attacks made up a significant portion of the first day's strikes. Over 100 of these million dollar missiles were fired during the first 24 hours but only at targets requiring a great degree of precision, i.e. targets located in civilian areas, near schools, hospitals, etc. The missiles were also used against heavily defended targets to minimize exposure of manned aircraft to hostile fire.

This initial phase of the air campaign was crucial. While there was little question concerning who would ultimately win the war, this first phase of the air campaign would decide the price of victory. Iraq was hopelessly outclassed but it could still extract a heavy price.

STRATEGIC TARGETS

Although the principal reason for the Gulf War was to eject Iraq from Kuwait, destruction of Iraq's nuclear, biological, and chemical (NBC) capability was equally important. Under the glare of world attention, Iraq was found to have quite an advanced weapons program. According to pre-war estimates Iraq had been anywhere from eight months to two years away from having a working nuclear device. Post-war revelations have showed how little we actually knew about Iraq's nuclear weapons program. U.N. inspectors travelling through Iraq after the war uncovered whole facilities left untouched by the bombing.

Iraq's nuclear weapons program had been dispersed throughout the country following the Israeli strike at Osirak in June 1981. The Osirak strike and mysterious deaths of key Iraqi technicians had set the Iraqi program back years. Ironically, the Israeli strike was composed of F-16s with F-15s assigned as fighter escorts. Ten years later, the roles were reversed during Desert Storm. F-15s delivered laser-guided bombs on Iraqi facilities while F-16s flew escort. Had the Osirak complex not been hit, it is entirely possible that the Coalition might have been facing an Iraqi military in possession of one or more nuclear devices.

After the Israeli strike, the Tigris and Euphrates rivers became dotted with NBC complexes. The greatest concentration of these sites lay near Baghdad north along the Tigris to Mosul and Kirkuk. This area was chosen undoubtedly because it was considered safe from internal unrest by the Ba'athist regime. Not only were Republican Guard units stationed there but Saddam Hussein had family ties in this region. Born near Tikrit, just north of Baghdad, Hussein's political and religious connections were strongest in this area.

Also included in this first phase were strikes directed against Iraqi electric power facilities, the transportation network and oil industry. Reportedly, much of the electric grid was knocked out by Tomahawks missiles releasing spools of wire made of carbon fibers. The wire would float to earth to lay across power lines causing short circuits. (Other reports hint at Tomahawk missiles releasing confetti-like material to produce the same results.) When the cease-fire went into effect Iraq was left with only 15% of its pre-war electricity remaining.

With the civilian power grid knocked off line, the military was forced to crank up its generators. This had an added benefit for FLIR equipped aircraft searching out targets in populated areas. Military complexes radiating heat stuck out like sore thumbs against dark backgrounds.

Coalition aircraft were particularly effective against Iraq's transportation network. Because the country is conveniently divided by two major rivers, bridges were lucrative targets for several reasons. Many bridges over the Tigris and Euphrates contained fiber-optic communication lines. A break in a bridge would mean a break in communications. Secondly, all military traffic and supplies had to cross at least one of these unfordable rivers on the way into Kuwait. Once these spans were dropped, the troops in Kuwait were effectively isolated. Not only could military traffic be prevented from crossing, congestion at these downed bridges would present Coalition pilots with concentrated targets.

Having damaged Iraq's principal means of C^3I, the air campaign could now direct its energy towards destroying Iraq's air force. This could be accomplished either on the ground or in the air but the preferred method was of course, to destroy them on the ground where they posed no threat. With this in mind, F-15Es and F-117As began a series of strikes on the hardened aircraft shelters. When Iraqi pilots did manage to get airborne they were immediately detected by AWACS and engaged by F-15s. The fact that Saddam had the chief of his air force taken out and shot is but one indication of the Coalition's effectiveness.

Strikes directed against the Iraqi air force continued throughout the campaign even though air superiority had been achieved early on. Declaring air superiority over Iraq became a matter of splitting hairs with the media over semantics. Did we have air superiority or was it air supremacy? No matter what name you gave it, Coalition pilots owned the sky over Iraq and the hardened shelters proved incapable of protecting enemy aircraft on the ground. With no other way to save themselves, Iraqi pilots began flying their aircraft to Iranian airfields. More than anything else, these desperate flights to Iran demonstrated that the Coalition had won the air war over Iraq.

INSTANT THUNDER PHASE 2

After Iraq's key targets and installations were struck, emphasis shifted towards establishing air superiority over the Kuwaiti Theater of Operations or KTO. This second phase called for numerous ground strikes against mobile SAM and triple-A sites stationed with Iraqi units in the field. These sites were not tied into the national defense scheme but were intended to protect maneuver units. By attacking these assets, Iraq's air defense umbrella was stripped away prior to the start of the ground war. When the ground war commenced these units were completely open and vulnerable to close air support missions.

INSTANT THUNDER PHASE 3

The third phase of the air war began after Iraq's ability to interfere with tactical air support missions was eliminated. Known as "shaping the battlefield" this phase concentrated on attacking various ground targets supporting enemy troops at the front. F-15s were called upon to eliminate logistic support centers and disrupt supply traffic heading to Iraqi troops at the front.

In Vietnam the USAF had been unable to accomplish this mission to the degree necessary. The jungle cover had made the job of detecting enemy supplies coming down the Ho Chi Minh trail far too difficult. The North Vietnamese were also able to capitalize on the fact that U.S. aircraft were unable to "see" at night. The unsophisticated nature of their forces required far less supply to maintain his combat operations. NVA "beans and bullets" re-supply operations could easily be transported on the backs of individual soldiers.

The Gulf War was an entirely different situation. Not only were supply routes traced over desert terrain (hence very little overhead cover) but these routes could be effectively interdicted by destroying only a few bridges. Moreover, the Iraqi army in Kuwait was highly mechanized and required huge amounts of supply just to survive, let alone maintain combat readiness. Unlike Vietnam, Iraqi logistics were given no respite at night either. Ground surveillance went on around the clock and anything that moved was attacked.

INSTANT THUNDER PHASE 4

Although by now a significant portion of F-15E missions were Scud hunts, Strike Eagles also assisted in the final phase of the air campaign, direct ground support. To aid the F-15s, Joint Surveillance and Target Attack Radar System aircraft (J-STARS) could look deep into Iraq and "see" enemy ground activity. If the enemy moved, J-STARS instantly detected it and F-15s would pounce on it. Movement on the ground ultimately proved fatal.

Faced with no alternative, Iraqi ground troops simply dug deeper and in so doing planted the seeds of their own destruction. During this phase of the air campaign, F-15Es were spared from other duties and assigned to nightly "tank-plinking" missions. The dug-in Iraqi armor was now helpless, unable to move and unable to hide, even at night. The LANTIRN-equipped Eagles swooped in and destroyed the armored vehicles one after another. A new chapter was being written in the history of air combat.

As Chairman of the Joint Chiefs of Staff, General Colin L. Powell had stated, the strategy was first to, "cut the Iraqi army off, and then kill it." Airpower had made it possible. The war had been so one-sided that after 100 hours it had to be called off, the other side was leaving the field. Iraq's army had been broken by incessant bombing and was reduced to an unwashed rabble fleeing Kuwait.

THE GREAT SCUD HUNT

Even though the Coalition won the war convincingly in a very short time, it was not without its share of surprises. One of these surprises had been the mass exodus of the Iraqi air force to Iran. Far more deadly, however, was the surprise awaiting the Coalition as evening came on the third day of the war.

True to his word, Saddam Hussein unleashed a salvo of Scud ballistic missiles at Israel and Saudi Arabia. The Coalition had been lulled into a false sense of security by its own glowing press accounts of the battle. So it came as somewhat of a shock that after suffering two nights of heavy aerial bombardment, Iraq proved it could take back the initiative. It had retained the ability to launch ballistic missiles and influence the course of the war. The Coalition's worst nightmare was coming true.

SSG Jim Gomez, U.S. Army

The Scud campaign was one of the most controversial aspects of the war. Clearly there had been a pre-war intelligence failure to detect the existence of so many mobile launchers and missiles. Initially, intelligence sources figured Iraq possessed around 36 mobile launchers but with the beginning of the air campaign, Coalition pilots began placing the number of launchers in the hundreds.

Because the Coalition had so poorly estimated the number of launchers, little effort was devoted toward destroying them at first. It wasn't until after Scuds began striking Israel that the anti-Scud campaign began in earnest. By then it was too late, the launchers were well dispersed and tucked away.

In terms of combat efficiency, the military threat posed by Scud missiles was insignificant. With only inertial guidance and small payload, the missile has evolved very little from its first generation cousin, Germany's V-2 rocket. It is designed to provide tactical support at ranges greater than conventional artillery but without active guidance the Scud is simply aimed in the direction of the target. At a pre-set time the missile's engine is turned off causing it to nose over and detonate on impact.

Once launched the missile's flight trajectory cannot be altered. In many respects it is not much brighter than a child's bottle-rocket. The missile is fired with range and bearing information only giving it a Circular Error Probability (CEP) that is measured in thousands of feet. To be effective, the Scud requires a large stationary target like a city. Iraq had modified its inventory of Scud missiles by dramatically increasing their range.

The two new versions of Scud missiles were named *Al-Hussein* and *Al-Abbas*. With increased range ,however, came a decrease in payload and accuracy. Hussein's missiles now had even less military value than before. They were meant only to be weapons of terror to be used against civilians. Because the warhead could contain only a small amount of high explosive the real fear was that these modified missiles might contain chemical payloads.

During the Gulf War Scud missiles played a role which far out-weighed their military importance. Lacking an air force to strike back, firing off Scud missiles showed the world that Iraq could survive the best efforts of the Coalition. But the indiscriminate launching of Scud missiles had an even more sinister purpose. Hussein hoped to use his missiles as a political ploy to drag Israel into the war.

In contrast to the reluctance concerning declaration of air superiority, Coalition briefers seemed willing to state early on that the Scud threat had been dealt with. Israeli civilians breathed a cautious sigh of relief at the news. When sirens all across the country began wailing, the early optimism turned to panic. Scud missiles were headed for the state of Israel after all. One could only guess at their contents.

For Hussein, striking Israel was a win-win stratagem regardless of what Israel's response might be. Israel certainly could not add to the damage already being inflicted on his country and he could portray himself as a hero to the Arab people by attacking the Jewish state. Hussein was gambling that Arab sensitivities would cause them to withdraw from the Coalition, not wanting to appear to be aiding Israel in the destruction of another Arab nation. It cost him little while placing all kinds of diplomatic pressure on the U.S. and its allies. For Israel, a nation which prides itself on its military prowess, it was a political embarrassment. It was forced to accept help from foreign troops on its soil for the first time in its history.

Israel had built a reputation based on its policy of quick and decisive retaliation when attacked. Israel had two retaliatory options immediately available. It could launch its own airstrikes backed up by division-sized commando raids into western Iraq; or it could launch Jericho I missiles at Baghdad and return the favor. It chose to do neither at the request of the United States. For political reasons it was forced to absorb the Iraqi blows and bide its time.

The great hunt for Scud missile launchers was literally equivalent to searching for the proverbial "needle in the haystack." U.S. intelligence had seriously underestimated the number of mobile launchers available in Iraq. Fixed sites were more readily detected by satellite photography but mobile launchers presented a problem. Little more than a pickup truck with a launch rail on the back, mobile launchers could easily be disguised or hidden.

Often times the Scud launchers would only be detected after they had launched their missile. Once a missile was launched, it would become a matter of tracking the mobile launchers back to their hiding places. Great use was also made of Special-Forces teams placed well behind enemy lines. Special Forces teams in sophisticated dune-buggies were able to pinpoint Scud locations with hand-held lasers and then call in F-15s with devastating accuracy.

It was estimated that the effort to find and eliminate the launchers cost the Coalition approximately one week's worth of sorties. F-15Es with their Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) laser-designating pods became major players. In fact, over half of all F-15E missions flown during Desert Storm were directed against the mobile Scud launchers. The F-15E flew approximately 2,200 sorties with only two combat losses. Both aircraft were lost while hunting Scud launchers in western Iraq.

Despite the difficulties, Scud launchings were dramatically curtailed after the first two weeks of the campaign. By the end of the second week, 43 had been launched. Iraq was only able to launch six more during the whole third week as the anti-Scud effort gathered steam. F-15Es could only do so much, however. To be effective Coalition pilots would almost have to know in advance where the missiles were located.

As the war progressed, the number of missile launches did in fact drop off appreciably. Whether this was due to Coalition efforts or because the Iraqis were running out of missiles is not clear. There is anecdotal evidence to support both theories. One thing is certain. Scuds continued to fall on Israel and Saudi Arabia right until the end of the war.

Although each Arab member of the Coalition reaffirmed its commitment to the Coalition, who really knows what the outcome might have been if Israel had responded? Overflights may have driven Jordan and Israel to the brink of war. Syria, whose troops had occupied Lebanon while everyone's attention was on Iraq, might well have pulled out of the coalition. President Assad may have decided that Syria had already gotten as much out of the war as it was likely to get. Taking a long term view of the situation Syria's geo-political interests might have been better served by making amends with Iraq.

LEADERSHIP

An important reason for the success of Desert Storm was the defeat in Vietnam. Since the Vietnam War a generation of military leadership has had time to reflect upon those mistakes. Many of Desert Storm's top leaders were junior officers back then. Coming up through the ranks they got a first hand look at the effects of mismanagement and failed policy. From the President on, military leaders felt obliged to reassure the American public that this war would not be another Vietnam.

The biggest mistake made during the Vietnam War was to commit military forces without widespread domestic support for the conflict. Rather than being a force for national unity like World War II, the Vietnam War was divisive. This "Vietnam syndrome," the idea that Americans are reluctant to use force fearing domestic unrest, has plagued our national psychology since 1972. Military leaders wanted Desert Storm to put this notion to rest once and for all. Although some factions within the United States differed on the sanctions question, an overwhelming majority of Americans supported the President's action once war was underway. With the nation solidly behind the men in uniform, America proved its people still had the will to fight if necessary.

COMMAND AND CONTROL

The Coalition air campaign was an extremely complex undertaking. Imagine trying to efficiently manage the combined air assets of a multi-national force, each nation having different types of aircraft with different

arming and maintenance requirements. Consider scheduling missions utilizing all these various aircraft in concert, all flying at different altitudes and speeds, in all kinds of weather, day and night. Remember that all these operations are taking place in a relatively confined space and you are quickly able to visualize an air traffic controller's nightmare. Oh yes, add in one last minor detail, the fact that there is a war on and you begin to get an idea of the magnitude of the job.

The amazing success of the air campaign came without a single incident of blue on blue air loss (*fratricide*). This fact alone is a testament to the professionalism of the Coalition air forces. The campaign could not have happened if not for the extraordinary amount of planning and preparation that went into organizing the effort. Much of this planning took the form of Pentagon staffers creating hypothetical war scenarios and identifying possible problems well in advance.

IRANIAN EXODUS

The Iraqi decision to send its top of the line aircraft to Iran was puzzling to Western analysts. There was speculation in the press that Saddam Hussein was husbanding his aircraft for later use in some type of surge operation. Others believed that the Iraqi aircraft based in Iran would be used to outflank U.S. naval groups in the Persian Gulf. Their wild theories just go to prove that reporters make for lousy tacticians. (In fairness to the profession it should be pointed out that most generals would probably make lousy reporters.) The fact that Iraqi aircraft were placing themselves farther away from the battlefield by fleeing to Iran doesn't seem to have made much of an impression.

The optimal time for Iraq to have employed its air power was at the outset; in the first few days of the campaign when its integrated air defense system was still relatively intact. With each passing day, hundreds of Coalition sorties were gradually destroying Iraq's ability to coordinate its air effort.

The military analysts here at **MicroProse** theorize that between the second and third week of the campaign Hussein accepted the destruction of his air force as a foregone conclusion. Faced with this inevitability, we believe Hussein engaged in a bit of Machiavellian "realpolitik" and cut a deal with his former enemy. Perhaps having no alternative, Hussein may have decided to offer the aircraft to Iran as an added inducement to Iranian leaders not to stir up trouble among Iraq's Shiite population in the south. Conspiracy theorists will undoubtedly have a field day with this after tiring of JFK.

In the absence of any other compelling reason to emerge since the war, this seems to be the most likely explanation. The aircraft transfer may have also been intended to curry favor with the Iranian leadership with whom he still shared a lengthy border. To free troops stationed along that border, he had already given back territory taken in the Iran-Iraq war. The aircraft may have been further insurance against Iranian activity against his regime.

NBC CONSIDERATIONS

Once the initial suppression of Iraqi air defenses was considered accomplished, Coalition strikes began to target nuclear, chemical and biological (NBC) facilities. There was little fear that Iraq was in a position to use nuclear weapons during the conflict since Coalition strategists were reasonably certain that Iraq did not possess an operational device in 1991. The real fear was that Iraq might pull out of Kuwait and end the conflict before giving the Coalition an opportunity to destroy Iraq's weapons of mass destruction. For this reason, nuclear facilities were placed high on the list. Over five hundred sorties were used to strike 31 nuclear-related targets during the first few days of the air campaign.

Chemical and biological weapons were a different matter entirely. Iraq was known to possess stocks of chemical weapons, having previously used them on its own Kurdish population. Politically it was necessary to rapidly eliminate chemical weapon manufacturing centers as well as delivery systems. While the Coalition military forces were adequate trained and equipped to deal with chemicals, civilian populations were totally exposed. And after publicly threatening to burn half of Israel, no one doubted Hussein's intentions in this regard.

Iraqi chemical and biological weapons facilities were apparently disguised as fertilizer and pharmaceutical manufacturing plants. The trick is an old but effective one. Foreign contractors from one nation are called to construct a legitimate facility. Upon completion, the complex can then

be converted for military use by contractors from a different country. This same shell game construction was used by Libya in the 1980s to disguise its chemical weapon production.

COLLATERAL DAMAGE AND CIVILIAN CASUALTIES

The Vietnam-era specter of civilian casualties was again quite evident in the daily briefing from both Riyadh and Pentagon. It was clear that the spokesmen were conscious of the effect Iraqi civilian deaths would have on domestic support for the war. But beyond that was a sincere expression of regret and anguish over civilian deaths being caused by the bombing. Most officials went on at length about the precautions taken to minimize collateral damage. Mind you, many of these added restrictions exposed our pilots to greater risk.

Despite pilot restrictions and the high degree of precision obtained by our "smart" weapons, collateral damage did occur in isolated incidents. The military infrastructure was too interwoven within Iraqi society to prevent it entirely. Yet considering the amount of ordnance dropped on the country, civilian casualties were light. Naturally the Iraqi government did everything within its power to magnify the extent of damage done in civilian areas. These efforts included documented cases of intentional damage done by Iraq to its own structures.

Another fact which seems to have escaped most civilian observers is that the nightly fireworks display that Iraqi gunners were putting up over Baghdad was coming back down on their heads. The metal fragments and debris being created by all those exploding shells must have made venturing outdoors quite hazardous.

Iraqi civilians population had been expecting massive damage to occur in their residential areas. They were somewhat surprized after months of mental preparation that it did not happen. Anticipating air raids like those which took place during the London "blitz" in 1940, they were confused over the selective nature of our air strikes. Rather than demoralize or impress the average Iraqi, the population became enraged over air strikes they believed to be conducted out of sheer spitefulness.

One particular case of "civilian" damage which drew much media attention was the celebrated "Baby Milk Factory" at Abu Ghraib. The Baby Milk Factory story was first reported by the Iraqi government then picked up the international press. It involved an Iraqi facility involved in the production of biological weapons which had been destroyed in pin-point bombing. Iraq stated that the plant actually produced infant formula and condemned the Coalition for trying to deprive Iraqi children of their milk. To complete the charade, Iraqi TV showed workers picking through the debris dressed in smocks labeled "**BABY MILK FACTORY**" written in English.

It was a hilarious scam but sadly, some in this country were completely taken in by it. After the war a respected journalist was allowed to "tour" the site. His hosts invited him to sample some pure white residue neatly piled in the midst of this building which had been devastated in the airstrike. Well sure enough, it was powdered baby milk. Gee, it must have been a "Baby Milk Factory" after all.

Admittedly, some mistakes were made. A Defense Department analyst has since concluded that at least 50 out of the 800 strategic targets struck during the war were hit because of faulty intelligence. Not that each of these 50 resulted in civilian casualties, just that these targets were misidentified by U.S. intelligence prior to the war.

THE AMARIYA SHELTER

A campaign of this magnitude simply could not have been conducted without at least a few things going wrong. An intelligence failure was responsible for what would become Iraq's biggest propaganda windfall of the war, the destruction of the Amariya bomb shelter. Otherwise known as Department of Civil Defense Public Shelter #25, the Amariya shelter in the suburbs of Baghdad was used by Iraq's upper class, government officials and their families. Unfortunately, it was also being used as a communications center by the military.

Built initially during the Iran-Iraq war as a bomb shelter, the Amiriya shelter was subsequently converted into an electromagnetic pulse (EMP) hardened communications facility. In the war of words which followed the attack, U.S. officials were quick to point out that the facility had been fenced in with barbed-wire and camouflaged. Fences and armed guards are not what one would rationally expect to find outside of a civilian bomb shelter.

The Amiriya command center had been identified as a possible target and placed on the ATO early in the campaign. When Iraq's principal means of

communication broke down, the shelter was activated as a secondary command node. Tragically, what the Black Hole fraggers did not know was that the facility was doubling as a civilian bomb shelter at night.

On 12 February 1991 at 0430 hours, a single F-117A sent two 2,000 lb. laser-guided smart bombs crashing through the camouflaged roof of the structure. Penetrating the hardened concrete ceiling, the bombs detonated several floors down. Instantly killed in the blast were between 300 and 400 Iraqi civilians. The removal of their remains was broadcast live over Iraqi and U.S. television the next day.

An example of an equipment failure took place less than two days later during a raid on the bridge over the Euphrates river at Fallujah. Many Iraqi civilians were reportedly killed when a laser guided "smart bomb" proved not to be so smart and landed in a crowded marketplace. On 14 February, a RAF Tornado struck the bridge being laser designated by an RAF Buccaneer. One bomb failed to guide properly and landed some 800 yards east of the actual aiming point. Subsequent reports of at least 130 dead could not be confirmed.

The heavy, continuous bombing in the aftermath of these two incidents was beginning to generate sympathy for Iraq. The perception was that we were now merely "bouncing the rubble" and causing needless civilian suffering. International concern was growing that the U.S. was exceeding its U.N. mandate and destroying the country. It is notable that countries expressing the most concern were located the farthest away from Saddam. Very little compassion was being shown by Iraq's neighbors because perhaps they knew something the rest of the world didn't.

In a long war such as Vietnam, losing the propaganda battle had been our undoing. Collateral damage done to North Vietnam had led to charges that the U.S. was guilty of genocide. Clearly, the Iraqi leadership had studied the legacy of our involvement in Vietnam. By selectively showing damage to civilian residential areas, the Iraqi government was making use of its only truly effective weapon against our air campaign. Hussein was gambling that elements within our own society would force a premature cessation of the bombing campaign. Had the ground war not been so decisive, Hussein may have ultimately been proven right.

GULF WAR COMMENTARY

"Now you must be the thunder and lightning behind Desert Storm."

— General Norman H. Schwarzkopf

Although *MicroProse's F-15E Strike Eagle III* is intended to simulate the contributions of a single aircraft, much of the design effort went into developing an accurate campaign environment. It was evident from the start that the Iraq scenario would have to take into account the larger context of airpower in general. If nothing else, it may give you something to think about while seated in your cockpit on those long missions over Baghdad.

Desert Shield/Storm was such an anomalous event that it defies critical analysis in many respects. However, as the next millennium looms near, it will inevitably be studied as a model for conducting 21st century warfare. In the short time that has elapsed since the actual event, much has been written trying to place the war in proper historical perspective. The same people who before the war were predicting chemical devastation and horrendous American casualties are now writing post-war critiques. It is safe to say that most civilian writers are as far off now as they were before the war. By focusing on the sensational, they have missed the obvious.

F-15E missions did not just occur in a vacuum and in fact the whole theory behind the use of air power underwent a radical reevaluation during Desert Storm. Coalition pilots came close to realizing the dream of all air enthusiasts since Giulio Douhet wrote his treatise, The Command of the Air, in 1921. For the first time in history an entire nation was being defeated by men attacking from the air.

Having said that, it is important to realize the danger in making definitive conclusions based on our experience in Desert Storm. While the Persian Gulf conflict contained universal elements common to all wars, Desert Storm was an event unlikely to be repeated. For one thing, the Coalition faced an enemy which by the stupidity of its leaders, cooperated in its own destruction. The ineptitude of Saddam Hussein on a strategic level was astounding. Any operational analysis based on performance in Desert Storm is bound to be misleading if used to portend future conflicts.

Currently there is an ongoing debate within military circles over the effectiveness of the strategic air campaign, i.e. hitting targets within Iraq. While the efficacy of the tactical air support is not disputed, the necessity of bombing all those strategic targets is being criticized. The central point of the argument is that the Iraqi army collapsed as a result of direct airstrikes and that the effort spent on hitting strategic targets was wasted. Furthermore, air assets utilized in the strategic campaign would have had a far greater effect had they been used in a tactical support role from day one. Lastly, and perhaps the salient point of the discussion is that the strategic bombing campaign had little correlation to the eventual outcome of the war.

Advocates of this position make valid points. Obviously, seeing your unit pounded into dust by tactical bombing will have a greater effect on morale than concern over targets being hit far off behind the lines. Troops at the front might even take some comfort in knowing that not everything is going to be thrown at them.

The counter to this argument is that the Gulf War provided the United States and its allies the chance to eliminate Iraq's potential to build nuclear weapons. By degrading the overall military infrastructure the Coalition was also seeking to redress an imbalance of power in the region. These reasons were at least as important as forcing the Iraqi army out of Kuwait. The strategic campaign against Iraq fulfilled a dual role that could be achieved no other way.

There is an old maxim which goes, we learn the most from our mistakes. But as human beings, we have a tendency to stick to what works with the attitude if it ain't broke, don't fix it. Military planners are caught somewhere in the middle. On the one hand, it is hard to argue against success, but if the past has taught us anything, it is that no war is ever fought like the last. History books are filled with examples of nations being defeated because they used tactics carried over from the previous conflict.

The Gulf War is no different in this respect. The strategies and tactics used successfully by the Coalition will ultimately have a short shelf life. Most of the lessons learned during the war will be recognized in time as unique to this conflict. Over 100,000 combat sorties were flown in support of Operation Desert Storm. Only 28 U.S. fixed-wing aircraft were lost for an unbelieveably low attrition rate of 0.03%. A rate this low is unlikely to be matched in any future conflict.

In the Desert Storm scenario, you will be called upon to perform many of the missions actually conducted during the war. Seated in your F-15E at Al Kharg, you and your "Wizzo" will have one last chance to go over the upcoming mission. On route to the target a myriad of technical sensors and electronic devices are working automatically to make your missions go smoothly. Still, success will depend in large degree upon your piloting skill.

The focus of your missions will be delivering ordnance on a variety of Iraqi targets, both strategic and tactical in nature. This is not to say that the air to air threat is missing, it isn't. The few Iraqi planes that do manage to get off the ground are usually flown by their top pilots. Even though they are Iraqi and not Soviet pilots, a MiG-29 is a MiG-29. You fly the plane, let your Wizzo lock 'em up.

Certain missions require that you go "downtown" into the heart of Baghdad and the heaviest concentration of triple-A in the Gulf region. Other missions, such as interdiction strikes on roads and bridges are less risky but no less demanding. Scuds remain a priority target. Anti-Scud patrols may be less glamorous than streaking over Baghdad but you

F-15 OVER BAGDAD

already know how important these missions are. You may not get them all but every Scud site or launcher you knock out is one less Saddam can use to terrorize innocent civilians. How's that for job satisfaction?

One final word about ground strikes. Even though your ordnance consists of precision guided munitions, accidents do happen. Central Command is counting on you to be extremely careful when delivering ordnance. You have already read how collateral damage is used by the enemy to wage a propaganda war back home. Don't make Hussein's job any easier. Avoiding civilian casualties and limiting collateral damage are paramount issues. Even if it means taking the long way towards a target, avoid extended flights over major residential areas where possible.

FUTURE MILITARY CONFRONTATION

The extent of Iraq's nuclear program is still being uncovered more than a year after the Gulf War. United Nations inspection teams continue to turn up elements of the program which were untouched by the war. Even more disturbing is Iraq's refusal to allow inspection teams access to certain facilities labelled as "agricultural plants." Given what we know about Iraq's elaborate deceptions, it should come as no surprise that documents relating to nuclear weapons production are stored in the Agriculture Ministry.

SSG Jim Gomez, U.S. Army

By standing up to the United Nations, Hussein will once again win the propaganda war even if Iraq suffers retaliatory damage. This time the United States will be unable to restrain Israel and ground combat in western Iraq will likelly ensue. Unfortunately, the only way this crisis will probably be resolved is by the death of Saddam Hussein, natural or otherwise. The Middle East is a powder-keg even on a good day without having to deal with an unstable despot in command of nuclear weapons.

A resumption of this conflict is likely to follow a far different pattern than the previous campaign. The United States will once again rely on airstrikes against Iraqi production facilities and military installations. As before, wholesale military occupation of Iraq will be impractical even if sufficient ground forces remained in theater. Strategic bombing will once again become the UN's only viable leverage over the Iraqi warlord.

After having agreed to permit Iraqi helicopter flights during the cease-fire negotiations, on 27 August 1992 at 1015 hrs (EST) the UN imposed a "No-fly Zone" over Iraq south of the 32nd parallel. Continued Iraqi human rights abuses against rebellious Shi'ites in southern Iraq had proven to be an embarassment to the U.S. administration. The post-war bungling that allowed Hussein to massacre and make refugees out of tens of thousands of Kurds would not be repeated.

The Shi'ite population is centered in salt-marsh areas south of Basra. Unable to reach them on the ground, the Iraqi military began using the remaints of its airpower to strike at them. With the institution of a No-Fly Zone, the U.S. and its allies are effectively providing an active CAP over southern Iraq. Until now, Iraq has not sought to challenge U.S. aircraft south of the parallel. There have been a few exceptions, however, mainly lone MiGs intentionly straying close to the Zone.

Should a major violation of the No-Fly Zone occur at some point in the future, F-15s will undoubtedly become involved. The unsurpassed accuracy of the Eagle, coupled with its excellent defensive ability, makes this aircraft the logical choice for payback.

PRE-WAR IRAQI ORDER OF BATTLE

GROUND UNITS:

Regular Ground Forces: 6 Armored divisions, 3 Mechanized Infantry divisions, 1 Naval Infantry division, 10 Motorized Infantry divisions, 17 Infantry divisions, 14 Reserve Infantry divisions, 1 Air Assault Brigade

Republican Guards: 2 Armored divisions, 1 Mechanized division, 1 Motorized Infantry division, 3 Infantry divisions, 1 Special Forces division, 2 Surface-to-Surface Missile Brigades (Scud, FROG)

Major Equipment: (5500) MBTs T55/62/72, (2000) AFVs BMP, M-113, EE-11 URUTU, BTR 50/60/152, (2000) SPA and towed artillery pieces 85/100/122/130/152mm, 155GCT SPA, BM-21, ASTROS II

NAVAL UNITS:

(1) Training Frigate, (6) Osa I, (4) Osa II, (4) ZHUK patrol boats, (3) SO-1 patrol boats, (2) Poluchat class patrol Boats, (1) T-43 minesweeper/layer, (3) Yevgenya class minesweepers, (4) Nestin class minesweepers, (3) Polnocny landing ships, plus several RO-RO cargo vessels

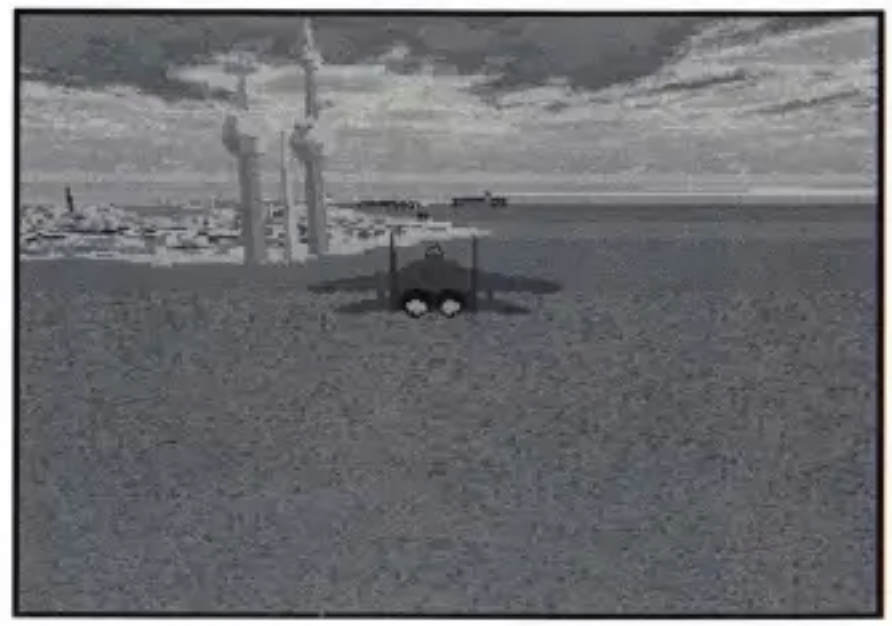
AIR FORCE:

Major Equipment: (250) MiG-21/23/25/29, (125) SU-7/20/24/25, (100) Mirage F-1, (12) IL-76, (40) A-5 Fantan, (80) Jian F6/7, (8) AN-12, (12) AN-26

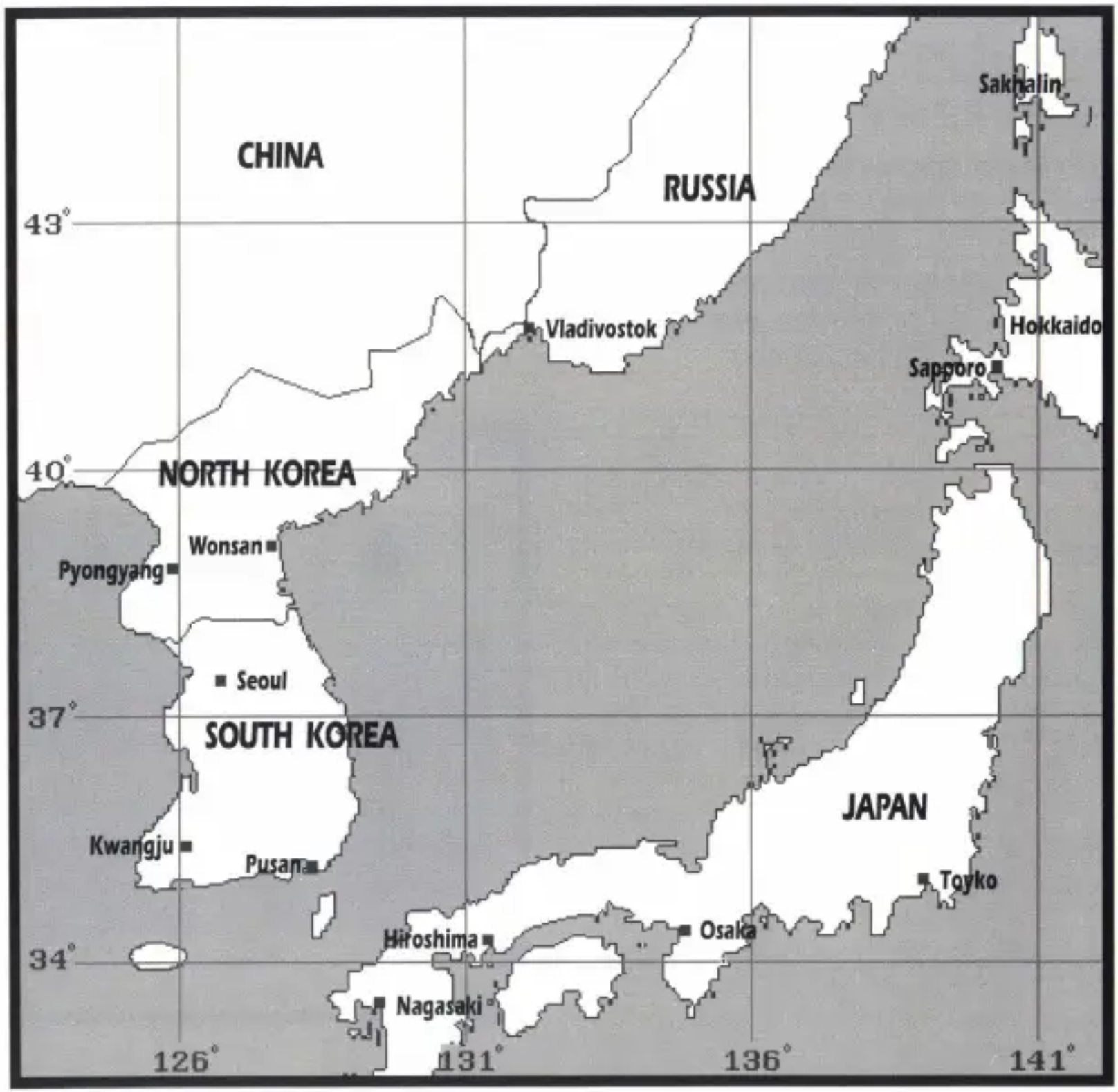
AIR DEFENSE:

Major Equipment: SA-2/3/6/7/8/9/14, Roland

F-15 NEARING KUWAIT CITY WATER TOWERS



THEATER MAP - KOREA



II. KOREA: RETURN TO MIG ALLEY SCENARIO

HISTORY OF THE "FIRST" KOREAN WAR

KIM IL-SUNG INVADES SOUTH KOREA

On a sleepy Sunday morning in June 1950, North Korea flung 10 infantry divisions and more than 150 T-34 tanks south across the 38th Parallel into South Korea. In an effort to unite the two countries, the puppet government of Kim Il-Sung had launched a surprise invasion. Only weeks before, the U.S. State Department had delineated those areas in the Pacific which it considered vital. The fact that South Korea was absent from the list was duly noted by the North Korean communists. Kim was convinced that he need not fear U.S. intervention.

Caught unawares by the ferocity of this massive assault the Republic of South Korea (ROK) was devastated. The ROK army was simply ill-equipped to deal with the North Korean armor which spearheaded the offensive. By the end of July, over 40% of the South Korea army had been destroyed. United States ground forces stationed in-country were likewise swept aside. Largely a constabulary force, the troops in Korea had suffered due to budget cuts in the post World War II demobilization. If South Korea was going to be held it would have be by outside forces.

The capital of South Korea, Seoul, was quickly taken by the North Koreans. Being located very near the border the city had little chance to prepare an adequate defense. As the ROK army broke apart and fled south, the United Nations voted to intervene in the conflict. NKPA forces, flushed with success, continued their push southward more concerned with speed rather than their safety.

"SPEED BUMPS"

U.S. troops were rushed to South Korea hoping to stem the tide but were committed piecemeal. Acting as "speed bumps" to slow the North Korean drive, units of the U.S. 24th Division were sacrificed in the process. By September, the remaining U.S. and South Korean forces were confined to an ever-shrinking slice of the peninsula known as the Pusan perimeter.

The USAF, like the army, had been ill-prepared to meet the communist invasion. Nominal control of U.S. aircraft in the region was assigned to the Far Eastern Air Forces or FEAF (rhymes with leaf). In the preceding decade FEAF's only mission had been to provide active air defense for General Douglas MacArthur's ground forces in the Far East Command. Essentially a deterrent force, the FEAF had practiced little of the air to ground operations which it would soon be called on to perform.

The U.S. Fifth Air Force, FEAF's largest subordinate command, was stationed in the Japanese home islands. During World War II it had moved north from Australia with the U.S. island-hoping drive across the Pacific. The tactical fighter component of the Fifth Air Force was equipped primarily with F-80C Shooting Stars, F-51 Mustangs and F-82 twin-fuselage Mustangs. Two understrength squadrons of B-26s Invaders made up the Fifth Air Force's sole bombardment group.

The South Korean Air Force (ROKAF) at the start of the war consisted of 16 prop-driven aircraft and a total of 57 pilots. Only 39 of these 57 pilots were considered fully trained. This meager force was caught and defeated on the ground during the first week of the war by Soviet built IL-10s, heirs to the famous Sturmoviks of WW II. The North Korean Air Force then proceeded to place South Korean airfields near Seoul and nearby Suwon under aerial siege.

For the second time in nine years, the United States was surprised by a hostile power, attacking on a Sunday when vigilance was low. It showed that the military had apparently learned little from the earlier Pearl Harbor debacle. Despite the general East-West tensions in this era of no-notice atomic oblivion, U.S. forces in the Pacific were taken totally off guard.

B-29 Super-fortresses belonging to the Twentieth Air Force were hurriedly redeployed to Japan. These heavy strategic bombers, once in

theater, were wasted on tactical support missions such as hunting down individual truck and tank convoys. Direct ground support missions were flown by F-80 and F-82s operating from Japan. Lacking proper anti-personnel ordnance, F-82s would jettison their fuel tanks over enemy troop concentrations as makeshift napalm.

INITIAL ATTEMPTS AT INTERDICTION

Numerous bridges, railroad marshalling yards, dams and rail tunnels had been attacked by medium altitude bombing. But, the effectiveness of these strikes was open to debate. Since the USAF lacked adequate photo-reconnaissance follow-up, bomb damage assessment was difficult. Ground fog and faulty maps certainly had a negative impact on the bombing campaign.

As ineffective as these tactics were, they were not completely without success. One of the most deadly air attacks of the war occurred during its first week. On 30 June, a flight of B-26s caught a North Korean column bottlenecked at a downed bridge near Seoul. Flying wing-tip to wing-tip the B-26s dropped their entire bombloads on the trapped column and destroyed hundreds of vehicles. In spite of these sporadic air attacks, North Korean armor remained road bound and presented the Fifth Air Force with excellent targets throughout their offensive.

KIMPO AND SUWON AIRFIELDS

The hasty retreat of UN and ROK ground forces toward Pusan however, placed the defense of South Korea in jeopardy. The two principal airfields in South Korea, Kimpo and Suwon were overrun early in the war. These two airbases were the only ones with airstrips long enough to support high performance aircraft. The third largest runway in South Korea was far to the south at Pusan. Unfortunately, its 4,900 ft. paved surface was torn up by heavily laden transports bringing in much needed reinforcements.

The loss of Kimpo and Suwon forced a redeployment of all jet aircraft to bases in Japan. This had a severe effect on combat operations since the USAF's principal jet fighters had such limited ranges. For example the F-80C "Shooting Star" the FEAF's principal fighter, at least in terms of numbers, had a combat radius of only 225 miles. Fuel consumption usually allowed the fighters only 15-20 minutes in a combat area before reaching "Bingo" fuel.

With this redeployment of jets taking place, F-51 Mustangs gained a new found prominence. As the commander of the Fifth Air Force put it, "One F-51 adequately supported and fought from Taegu airfield is equivalent to four F-80s based on Kyushu (Japan)." Relying on outdated equipment from the last war might have proved successful had not superior Soviet aircraft been introduced.

If control of the skies over South Korea was lost, the UN would be precluded from conducting the air missions which so far had been instrumental in staving off defeat. On a strategic level, the interdiction campaign had been the only means of slowing the flow of communist men and material into South Korea. Losing air superiority would also mean that the North Koreans would be given an opportunity to stage their own air attacks from captured South Korea bases.

The Fifth Air Force, recognizing this eventuality, shifted its emphasis from strategic interdiction to counter-air operations. The B-26s and B-29s which had heretofore been used against troop movements made enemy airfields their primary focus. In a series of devastating raids on North

HIGH-G TURN OVER SEOUL

HAN RIVER BRIDGES AT SEOUL (LOOKING NORTH)

Korean airfields, the bombers forced the North Korean air force to withdraw their into Manchuria.

THE PUSAN PERIMETER

By August 1950, the NKPA had come perilously close to conquering South Korea in a single lightning campaign. All that stood between North Koreans and victory was the last ditch UN toehold around Pusan. Operating at the end of a tenuous lifeline stretching back to North Korea, it was imperative for the enemy to finish off the Pusan bridgehead before superior UN forces could arrive. For several weeks it appeared that the North Koreans were about to succeed. But the fruits of the interdiction campaign were becoming evident. Manpower and supplies simply could not reach the North Koreans around Pusan in sufficient amounts to allow them to mount the final effort.

The amphibious landing at Inchon came at a time when the North Koreans were already on the ropes. Having exhausted themselves in an all-out effort to take South Korea, their army lay spent and broken. By the time the Inchon landings took place, UN forces outnumbered the North Koreans along the Pusan perimeter.

Contrary to popular belief, the Inchon operation had been pre-planned since before the war. The Joint Chiefs of Staff had always intended to conduct a landing at Inchon in opposition to a North Korea drive southwards. The operation, which made a certain general famous, took place in September. Despite tricky currents and tides, the Marines gained a foothold and turned the tide of battle. Seoul was retaken by U.S. Marines and suddenly the North Koreans down south seemed desperately overextended.

As news of the Inchon landings filtered down to the North Koreans along the perimeter their morale finally gave way. Subjected to terrible bombing and lacking supplies, the North Koreans were routed. MacArthur's mishandling of the counter-offensive had allowed a good portion of the NKPA to escape but without question the UN was in position to occupy North Korea at its leisure.

UN ground troops closed in on the Yalu River border with China as winter drew near. MacArthur was insistent that China would not enter the fray and U.S. troops began looking forward to being home in time for Christmas. They had inflicted a disastrous defeat upon the enemy and considered the campaign concluded. Well, MacArthur was wrong.

CHINESE INTERVENTION

The Chinese had surreptitiously deployed over 300,000 "volunteers" inside North Korea by November 1950. After repeatedly warning the U.N. to stay away from the Yalu, China had decided to intervene in the conflict. Their massive armies tore into U.S. units in the midst of their Thanksgiving celebrations. Their action saved the North Koreans from certain defeat and flung the UN forces fleeing headlong back into South Korea. There are perhaps no more poignant stories in the annals of military history than the saga of the frozen retreat from North Korea.

U.S. Army and Marines salvaged what they could and staged a fighting withdraw back down the peninsula. Many units still were cut off by the speed of the Chinese advance and had to be evacuated by sea. For the second time in the war Seoul was taken by the enemy. The Chinese

offensive however, had been slowed by USAF bombing just as the North Koreans before. The communists had once again outrun their ability to supply their troops at the front.

UN forces were able to establish a firm front along the narrow waist of Korea just south of Seoul. Any further Chinese attacks were met with determined resistance and thrown back; UN counter-attacks were similarly unsuccessful. There were now too many troops on both sides of the lines to make a war of maneuver possible. A maximum effort by the UN had barely managed to retake Seoul and suffered heavy casualties. By July 1951, both sides now recognized that the mobile phase of the Korean war had ended.

As the war entered this new phase, the prospects for either side achieving a decisive victory were slim. There were only two choices remaining; either continue the war under conditions reminiscent of World War I or opt for a negotiated settlement. Since the use of atomic weapons would mean an intolerable escalation of the conflict, a stalemate was inevitable.

After ranging up and down the peninsula for almost eighteen months, the war was going to have to be settled at the bargaining table. With MacArthur relieved of command by presidential order, the way was cleared for the diplomatic wrangling to begin. The unanswered question was at what point would the combatants decide that they had suffered enough and discuss terms for a cease-fire. The agreement would only be reached after both sides incurred hideous casualties in pre-ceasefire positioning.

AIR WAR OVER KOREA

"The Air Force is on trial in Korea."
— General Hoyt S. Vandenberg
Air Force JCS

North Korea began the war with 78 YAK-7Bs, 30 PO-2s, and 70 IL-10s, all of which were prop-driven relics of the last war. Most of these aircraft were destroyed during the Fifth Air Force's early counter-air operations in 1950. Once that was accomplished, air supremacy was easily maintained by continually pounding North Korean airfields.

In the face of the UN fall counter-offensive in 1950, the Soviet Union undertook a massive effort to supply their communist brethren with first rate jet aircraft. The Chinese Communist Forces (CCF), which had entered the war in November, received the first of 3,000 aircraft promised by Moscow.

THE MIG-15

Many of the new fighters reaching the Chinese were MiG-15s, the Soviet Union's hottest new interceptor. Its combat debut proved that the MiG-15 was without equal over Korea. Overnight, the F-80s and F-82s were being challenged by an opponent which could out dive and out turn them. The MiG-15 was also good 100mph faster in level flight than anything it would happen to come across. USAF Mustangs now flew over the battlefield at their peril.

The Fifth Air Force faced a window of vulnerability which would only be closed by deploying a fighter capable of taking on the MiG-15. Thankfully, as the Chinese armies plunged southward during the winter of 1950-51, the expected communist "aerial offensive" never materialized. It is possible that the CCF was reluctant to expose its aircraft to UN counter-air measures. More likely, the CCF was afraid that staging its air power outside of Manchuria might be viewed as a serious escalation of the war.

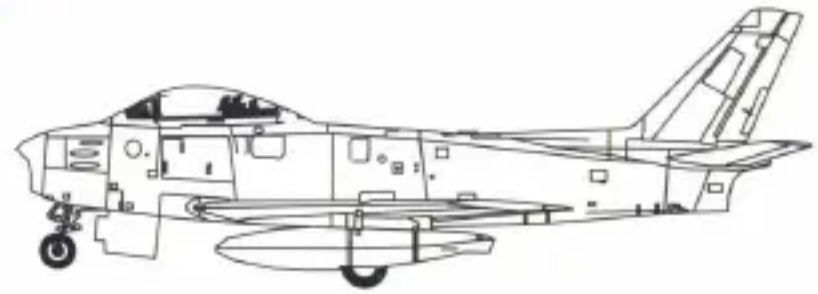
American ground troops were unaccustomed to not being able to call on air support. Communist leaders were unsure exactly how the U.S. would react to being subjected to a savage air campaign. Such an escalation, the Truman administration darkly hinted, could possibly lead to atomic retaliation.

The Chinese and North Koreans were not the only participants in this war to fear escalation. The United States was also concerned that provocative actions by its air force might lead to a general widening of the conflict. One of the most controversial decisions of the war had to do with the bombing of the infamous Yalu River bridges.

The Yalu River forms the northern border separating Chinese Manchuria from North Korea. When the Chinese army launched its campaign, the twelve major road and rail bridges over the Yalu provided the only means of supplying their massive army inside North Korea. Naturally these supply bottlenecks would have been excellent targets for UN interdiction missions.

MIG-15

F-86



MIG-29

F-15

Head-to Head; Then and Now

The MiG-15 made its combat debut during the Korean War. It came as quite a shock to the USAF whose prop-driven fighters were quickly routed off the battlefield. Ordered into production in 1948, these aircraft were flown from the assembly line straight into combat. In response, the United States began to offer a bounty for each MiG-15 pilot who defected with his aircraft. Known as Project "Moolah", the scheme was successful in bringing in a few stray MiGs.

The F-86 Sabrejets were able to incorporate design features copied from the defector's aircraft. Although the MiGs had their own limitations, they were an even match for the Sabrejet. Quick and very maneuverable, the MiGs also packed a more powerful punch. The F-86 Sabrejets were undergunned but benefitted from a stabilized gunsight that the MiGs lacked. Only the advanced level of pilot training and tactical co-ordination allowed the F-86 to compete successfully for control of "MiG Alley."

Sabrejet pilots would be astounded at the array of sophisticated targeting and flight systems available to the Eagle drivers. The cockpit would be totally alien and unfamiliar place. The same would be true for the MiG-15 pilot stepping into a Fulcrum for the first time.

As the century comes to a close, it remains a tight race for air supremacy. Again the clean, aerodynamic lines of the MiG-29 and F-15 give an external appearance of similarity which belies their internal differences. The long range capabilities of these aircraft tend to make maneuverability a moot consideration. Rather than compare flight envelopes, in the 1990s we tend to think in terms of systems, radars and weapons. The aircraft itself is only thought off as the vehicle providing mobility to these systems. As before, the deciding factor in air combat may come down to simple pilot training and individual skills.

As tempting as these targets were, UN aircraft were forbidden to bomb that close to the Chinese border. Using the standard iron bombs of the day, the United States was unwilling to undertake the considerable risk of collateral damage within China's national boundary.

The chance of inadvertently straying into Chinese airspace would be great on such missions. Since the Yalu river formed the border, USAF bombers would be forced to make their approach runs at a perpendicular angle to the bridges. The chances of scoring hits on the bridges using this type of attack profile were minimal. The better method of attack using unguided munitions would have been to approach along the bridge axis. Pilots would certainly have had to cross into Chinese airspace to carry out these attacks, either on the bombing run or while exiting.

THE 4TH TFW ENTERS MIG ALLEY

With the introduction of the MiG-15, the hotly contested area surrounding the Yalu River quickly became known to U.S. pilots as "MiG Alley." The USAF responded to the MiG-15 by sending the 4th Fighter-Interceptor Wing and 27th Fighter-Escort Wing to Korea. These units, made up of F-84E Thunderjets and F-86 Sabrejets, were given their movement orders on 8 November. The 4th Fighter Wing, stationed in New Castle County Airport in Wilmington, Delaware, flew to San Diego where it was put aboard ship. By 15 December, F-86s from the 4th Fighter Wing were flying CAP over northwestern Korea, the heart of MiG alley.

The MiG-15 could claim a marginal superiority over the F-86 at high altitudes. Being lighter, the MiG could climb somewhat faster and had a higher operational ceiling than the F-86. The MiG's swept-wing design gave it a top end speed of almost 660 miles per hour. On a good day with an experienced pilot behind the stick, the MiG could hold its own. The F-86, on the other hand, was more suited to lower altitude combat. The plane picked up momentum in a dive like a falling safe but tended to bleed off energy quickly once returning to level flight. In combat the F-86's .50 caliber machineguns lacked the punch of the MiG's cannons but could still shred an enemy aircraft in seconds.

The 336th Squadron, partially based at Kimpo, got its first recorded MiG-15 kill on 17 December only days after arriving in country. The other two squadrons, the 334th and 335th were stationed outside of Tokyo. These squadrons had to make the long flight to Korea and back on each mission. By the end of the year (1950), the 4th Fighter Wing had racked up 234 counter-air sorties and claimed eight confirmed MiGs shot down.

POLITICAL CONSIDERATIONS

Along the length of "MiG Alley" Chinese MiGs would climb above U.S. patrols while still inside Chinese airspace. Having reached a position above and behind, the MiGs would then dash across the border to strike the U.S. formations from a point of maximum advantage. Making only a single pass, they would "blow through" and then dash to safety over the border. Although MiG pilots tended to rely on slashing attacks from above, the plane was actually more suited to horizontal engagements.

Chinese MiGs were also making life uncomfortable for the multi-engined bombers performing missions near the border. The favorite tactic was again to use Chinese airspace to reach a superior altitude. Once in position the MiGs would dive on the bomber formations and convert that dive energy into speed for the quick getaway back over the border.

Fuel consumption, which placed severe restrictions U.S fighters, was not a concern for the MiG pilots. The Chinese established major airfields literally only minutes from the border. Antung (Dandong) airbase located at the mouth of the Yalu was particularly active during this period. MiGs from this base took a heavy toll of B-29s on bombing raids near the border.

USAF pilots were expressly prohibited from engaging in "hot pursuit" into Chinese airspace. In effect, the MiG-15s were given safe conduct passes back to their Manchurian airfields. Despite the handicaps, UN pilots made a good showing for themselves. Superior training and coordination more than made up for the deficiencies. By the end of the war, UN pilots had destroyed over 800 MiG-15s in air-to-air combat while losing just over a hundred of their own. By 1952, UN pilots were enjoying a kill ratio of well over 13-1.

Even without being able to strike the Yalu bridges, the restrictive nature of North Korean terrain allowed the strategic bombing campaign to concentrate on just a few access routes. The mountainous regions and swift moving rivers confined supply columns to the easily identified road network. UN aircraft kept up continuous patrols over the network of roads

and immediately pounced on any Chinese that happened along. As the UN retreat from North Korea was taking place, the Chinese were decimated as they attempted to pursue.

Even though the communist ground offensive had slowed, the intensity of the air war had not. In fact, MiG pilots were becoming even more aggressive. The B-29 bomber streams flying night missions for safety now found themselves being engaged by night fighters. Communist radar stations were being established in North Korea to help direct the MiGs to their targets.

As the ground war spilled into South Korea, communist aircraft began to experience the same problems that had plagued UN pilots. Having to travel further to and from their Manchurian bases to reach the front, the MiGs had less time to spend over the battlefield. Flying outside the proximity of their Manchurian safe havens, the MiGs suffered accordingly. UN pilots maintained their control of South Korean airspace during daylight hours. Night was more of an even contest due primarily to the universal lack of effective night fighting equipment.

IN SEARCH OF A MISSION

Communist intransigence over terms for a cease-fire left military and political leaders looking for ways to employ their air power. One faction believed that air power could only anger the communists and keep them away from the bargaining table. Another faction believed the opposite, that increased pressure would force an armistice. The question remained how best to utilize aircraft and against what type of targets?

With the communist drive halted near the 38th Parallel, UN strategists in 1952 were forced to recognize that air power alone was unlikely to force the Chinese to come to terms. For one thing, North Korea received all its military equipment from outside sources. It did not have an indigenous industry capable of supporting the war effort. Hence, there was nothing to knock out that might cause a surrender.

"OPERATION STRANGLE"

The best air power was likely to achieve in 1952 was a continued campaign of interdicting communist supply routes. It was realized that this effort would not entice the Chinese to negotiate but it would forestall a renewed offensive until a solution could be found. The USAF had devised a massive campaign against the North Korean rail net and logistical support system known as "*Operation Strangle.*" The campaign was a repeat of the interdiction effort directed against roadways early in the war. For ten months, UN pilots laid siege to communist rail lines. Strangle failed due largely to the ability of peasant workers being able to repair the rail lines just as fast as they were destroyed.

In March 1952, Operation Strangle was replaced by a new tactic. Instead of interdicting wide areas of railroad, UN bombers were to concentrate on specific two-mile long sections of track. The idea was to obliterate sections of the railway rather than just causing temporary damage. The change in tactics was given the codename "*Operation Saturate.*" Unfortunately, communist workers proved too adept at repairing bomb damage. Heavy losses inflicted by triple-A forced a cancellation of interdiction efforts by the strategic bomber force.

With the armistice talks stalled and the failure of Strangle and Saturate, attention turned to a resumption of strategic bombing. From May 1952 until the end of the war, massed bomber formations were sent over North Korea to pressure the communists into accepting cease-fire terms. The air campaign toward the end of the war resembled the final days of World War II. Strategic bombing could not win a war alone, but it could be used effectively as a political weapon of persuasion.

RETURN TO MIG ALLEY: SCENARIO

Due to his advanced age, the death of Kim Il-Sung had hardly come as a surprise to anyone in North Korea. As happened with Japan's former emperor, Hirohito, the national leadership was paralyzed while in the midst of a death vigil. The portly, double-chinned dictator left North Korea without a clearly defined transfer of power. Kim had, after all, ruled the country ever since World War II. His xenophobic brand of Stalinism had kept an iron grip on government aided by an army of secret police and paid informants.

Though espousing the communist line, Kim Il-Sung had been a monarch in everything but name. While living, Kim had done his best to insure that the mantle of government would be passed along to his heir.

F-15 IN THE HILLS OF KOREA

His son, the younger Kim, fancies himself a modern-day Alexander the Great, eager to assume his father's position and titles. And just as Alexander's father Philip had bequeathed him the Macedonian phalanx, the elder Kim had left behind a phalanx of Soviet tanks and aircraft. Thanks to his father's adroit diplomatic skill at playing China and the Soviet Union against one another, young Kim stood to inherit an awesome military machine.

THE PRODIGAL SON

Like all ambitious sons, the young Kim aspires to surpass even his father's former glory. Having had many years to silently contemplate this moment, he has moved swiftly to eliminate his opposition within the party apparatus. He will succeed where his father had failed and in so doing, he will be the one people remember, and not his father.

Gone are all those men who fed their personal ambitions by orbiting around his father. Gone too, are all those in the cabinet who counseled moderation. Just as his father before him, Kim alone knows what is best for the Korean people. Taking his cue from the success of German reunification, Kim has decided to bring together north and south, under his leadership, of course. By merging the populous south with the industrial north, Kim's plan is to forge an economic powerhouse more powerful than any other along the Pacific rim.

Although the Japanese were far ahead for now, he mused, their society was fast becoming too decadent and westernized. In Kim's mind, as the Japanese people begin to demand the fruits of their economic miracle and decades of hard work, they will become soft. Just as the capitalist West had allowed the Japanese to overtake them, Korea would in turn displace the Japanese. Like the Americans who had allowed their industrial base to erode into a service economy, the Japanese would do the same. Human nature and the pursuit of luxury would do his work for him.

Naturally he could not expect to walk into South Korea unopposed. South Korea governments had provided the people with a modicum of personal liberties and a standard of living that most found acceptable. His biggest allies inside South Korea were leftist agitators on university campuses. Using student demonstrations to ferment unrest was an inexpensive means of shaking up the government. Continued student demonstrations turned into serious civil disturbances requiring the government to react, sometimes violently. The students repeatedly protested against U.S. "imperialism" and called for reunification. Having been financed and supported by North Korean "bagmen," the demonstrations were certainly giving Kim his money's worth.

NORTH KOREA'S NUCLEAR THREAT

Over the past decade, the North Korean nuclear program had progressed smartly. It had benefited by not being in the spotlight of world attention as had certain Middle Eastern nations. Because of oil, the United States had become intimately familiar with the Arab world. Lacking oil, most Americans couldn't find North Korea on a map.

Except for a couple of back-page newspaper articles, the North Korean nuclear complex at Yongbyon had been constructed and brought on-line with little fanfare. Using a tributary of the Chongchon for reactor coolant, Yongbyon had for many months been processing weapons-grade

plutonium from nuclear waste. Because of the North Korean penchant for burying their facilities, most of Yongbyon was underground, away from prying eyes.

The overall military and political strategy of North Korea could make little use of the nuclear weapons being produced. It was hard to envisage a situation where nuclear weapons would be used against South Korea, the very territory they hoped to occupy intact. Possession of nuclear weapons for their deterrent effect was also discounted. Even Kim Il Sung was not so deluded as to believe that the Soviet Union, United States or even China would be deterred by North Korea's tiny nuclear arsenal. Lacking a capability to deliver nuclear weapons out of theater, North Korean was inviting retaliatory destruction just by possessing them.

Why then, a nuclear weapons program? For North Korea, the whole point of their nuclear program was to produce weapons to be sold abroad. Of course North Korea might keep one or two low yield tactical warheads on hand, but for the most part nuclear weapons were built to sell. The money or bartered goods these weapons could bring would then be used to buy more useful conventional arms. With the Soviet military now holding a garage sale, North Korea would be able to re-equip itself on the cheap.

THE IRAQI CONNECTION

One of the best potential customers was Iraq. Following the Persian Gulf War, Iraq's own nuclear weapons program lay in ruins. Its most crucial facilities been leveled during the war. After the war, UN inspection teams uncovered additional facilities untouched by the bombing. With the world now alert, rejuvenating Iraq's nuclear program would be impossible. A startup program would be too visible and just too costly. The fastest and safest way to acquire nuclear weapons from now on was to buy or steal them.

Although details are quite sketchy, it appears that a number of Iraq's special service operatives were caught inside the former Soviet Union trying to capture a special weapons storage complex. Apparently, a firefight erupted between the Iraqi commandos and a Soviet security detachment. The security force was only able to gain the upper hand following the explosion of an Iraqi transport loaded with ammunition. The majority of the commando team went up along with the plane. The remaining Iraqis were captured and killed outright or taken in for interrogation. The raid had left a lot of Russian soldiers, most of them teenagers, lying dead on the ground. Moscow was not happy. Many of the captured Iraqi commandos were in for a rough time. Vae V***ictus.***

Having failed in their attempt to steal a warhead, the Iraqis made secret overtures to the North Koreans. Since both governments were diplomatically isolated on the world stage, they found it easy to accept that fate had joined their two countries in this venture. A sales agreement was signed whereby North Korea agreed to deliver two 40 kiloton warheads along with mating schematics for Iraq's Scud missiles.

The purchase price was a minimum of 140 million barrels of Iraqi crude to be delivered over the next five years. In addition, North Korea would receive technical assistance in constructing a super gun like the one destroyed by the U.N. inspection team. Finally, North Korea would receive $1.2 billion dollars equivalent in U.S. currency upon receipt of the first warhead.

A FATEFUL VOYAGE

The first of the two warheads was loaded aboard a North Korean tanker, the *C'huche*, at Namp'o naval base less than a month after the agreement was signed. $1.2 billion would buy a lot of Soviet hardware and the young Kim was in a hurry. The *C'huche*, meaning "self-reliance," set sail for the Persian Gulf at a leisurely 15 knots trying to appear as inconspicuous as possible. On the return trip it would be loaded with Iraqi crude oil to further the deception.

Unbeknownst to the North Koreans, the tanker was being tracked by a U.S. Lacrosse surveillance satellite from the moment it left port. In a rare successful use of HUMINT resources, the National Security Agency (NSA) based at Fort Meade, Maryland had gotten wind of the transaction. Disgruntled members of Kim's ousted cabinet eager to see the usurper disappear had passed the information to U.S. officials.

Four days out of Namp'o, the *C'huche* was intercepted by surface elements of the U.S 7th Fleet. CH-53s (Sea Stallion) helicopters from the *USS Peleliu*, a Tarawa class LHA, dropped a Navy SEAL team directly on the tanker's spacious deck. Making the actual stop were two Spruance class destroyers, the *John Young* (DD 973) and *Ingersoll* (DD 990). Covering the operation from a distance was the *Thomas S. Gates* (CG 51), a Ticonderoga class guided-missile cruiser. Its powerful Aegis radar kept a constant vigil during the entire boarding procedure.

A nuclear device was located in the tanker's hold and removed by Explosive Ordnance Disposal (EOD) trained SEALs. In a tense transfer operation, the warhead was hoisted aboard one of the Sea Kings and flown directly to the *Peleliu*. U.S. Marines then boarded the *C'huche* and conducted a thorough top to bottom inspection. At the conclusion of the operation, ship and crew were allowed to continue.

Howls of protest and cries of international piracy immediately came from North Korean diplomats worldwide. To anyone who would listen, the North Koreans promised that this act of blatant theft would not go unpunished. While steadfastly denying that a nuclear weapon had been recovered, Kim charged the U.S. with deliberately interfering with North Korea's right to free trade on the high seas.

The Korean threats were viewed seriously by the administration but government officials believed they were prepared to deal with any eventuality. The State Department was quick to post travel advisories in its embassies and government employees were asked to delay their travel plans. The travel advisories were then very quickly made available to the general public. No one wished to repeat the controversy surrounding prior notification that occurred following the post-Lockerbie revelations.

Several days after the tanker was stopped, a South Korean freighter suddenly and mysteriously exploded in the Sea of Japan. Although rumors of sabotage were tossed around, one unconfirmed report mentioned witnesses seeing torpedo tracks. The report of a submarine was met with a good deal of skepticism until a second freighter blew up one day later.

Both the U.S. and South Korean governments lodged formal complaints at the United Nations in New York. North Korea, through its intermediaries, vehemently denied complicity in the sinking of the two freighters. It blamed the loss of these two ships on the South Korean government. According to the North Koreans, South Korea was engaged in planting contact mines off its coast. Undoubtedly, the two ships were lost as a result of premature detonations of the mines they were carrying.

Satellite reconnaissance of North Korean ports, however, showed that North Korean submarines were out in force. As a precautionary measure U.S. P-3 Orion sub-hunters began doubling their daily sweeps from their bases in Japan. With two ships lost in as many days, Lloyd's brokerage in London was threatening to suspend its underwriting of civilian merchant shipping entering the Sea of Japan.

After two days of stepped up efforts, a magnetic anomaly detection (or MAD) contact was finally made by an Orion crew some 220 nautical miles northeast of Wonsan. The P-3 bracketed the underwater contact with a neatly spaced double-row of sonobuoys set to active ping. Almost immediately the contact began evasive maneuvering but it was too late. Caught moving parallel to the buoys, the contact's revved-up prop returns identified it as a Whiskey class diesel-electric boat.

THE DEATH OF RENO ZERO-ONE

As the P-3 crew (designated *RENO 01*) continued to work the sub contact, an AWACS flying out of Misawa AB, Japan detected a pair of "bogeys" closing in on the sub-hunter from the north. The female controller's steady voice was easily recognizable above all the extraneous chatter.

"RENO 01, This is FREEBIRD. Hot Dog, Hot Dog, Hot Dog....Bogies bearing 327, Angels 5 at 100 miles."

"FREEBIRD, this RENO 01. Authenticate Bravo Thr..."

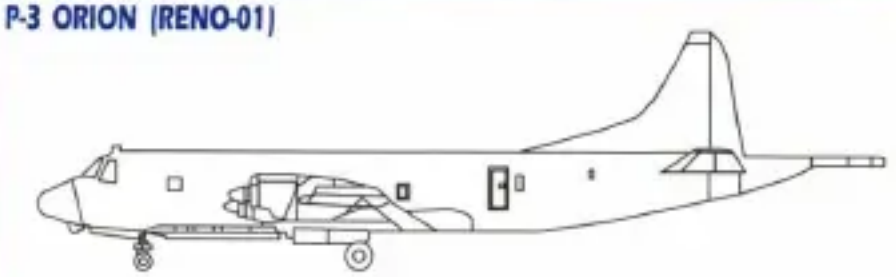
"Authenticate nothing, RENO 01. Clear outta' there. You've got a pair of MiGs in the neighborhood and headed your way. Come right to a heading of 125, that'll put 'em in your seven 'o clock."

"Roger, FREEBIRD. Can you call in some friendlies for me?"

"RENO 01, This is FREEBIRD. Already done. There's a couple of Eagle-Charlies on the way at the speed o' heat. Should be there in five."

"FREEBIRD, This is RENO 01. We just got a radar spike. I think they're really gonna' shoot. Tell those guys to hurry up."

P-3 ORION (RENO-01)



The intercept order had already gone out to the Ready Fives on the ground at Kunsan. It was clear that they would never reach *RENO 01* in time. Even though the Orion pilot had gone to full military power and was receiving guidance from the AWACS, the bogies' closure rate was just too high. The P-3 would not get away.

At a range of 40 nautical miles, two MiG-29A Fulcrums locked-up the slow moving sub-hunter on their "Slot Back" pulse-Doppler targeting radar. Closing to eight nautical miles the lead aircraft let loose a pair of AA-10 "Alamo-A" radar guided missiles. The J-band seekers in the missiles' nose cone would have no trouble in distinguishing the target. The radar cross section of a P-3 would look like a barn door to the missile's microchip brain. As the first AA-10 slammed into the plane's mid-section the second buried itself in the starboard wing before exploding.

RENO 01 immediately went into a 45 degree right bank and nosed over. It hit the water at over 300 knots, cartwheeled, and broke apart. The AWACS controller solemnly watched her screen showing the two MiGs retreat back into North Korean airspace and land at Toksan airfield outside of Hamhung. Two F-15Cs reached the sinking wreckage within minutes only to report back that no survivors were sighted.

Diplomatic communications between the White House and government ministry building in Pyongyang all but ceased. Instead, a heated series of back channel exchanges took place, full of charge and countercharge. The players weren't out to score debating points though; American military personnel were dead and North Korea was going to pay. This wasn't some tree clearing incident along the DMZ. This had been a deliberate attack in international airspace.

HAIL TO THE CHIEFS

Back on the flight line at Seymour-Johnson Air Force Base in North Carolina, F-15Es belonging to the 335th Fighter Squadron or "Chiefs" were in motion. A major redeployment to Korea was about to get underway and the eagle-keepers had their hands full. Arcing skyward in the predawn hours off runway 08, F-15Es left Seymour-Johnson in flights of six at one hour intervals.

The first leg of the long flight to Korea would take them over the Great Lakes and then north into Canada. The F-15s would need to rendezvous with at least four tankers before reaching their initial stopover in Alaska. As the lead group touched down on Elmendorf AFB's runway 25, over on the right the morning sun was reflecting off Mt. Mckinley's snow-capped peak.

The stay at Elmendorf was a brief one for the 335th crews. The pilots and "Wizzos" had just enough time to catch a quick nap and maybe grab a Moose-nugget key chain from the local Base Exchange as a souvenir. Maintenance crews at Elmendorf worked feverishly checking and rechecking flight systems for the "feet-wet" leg of the trip to Korea. After an abbreviated turn around, the men of the 335th were once again on their way.

Leveling off at flight level 260 (26,000 ft), the F-15 crews had not even settled in before having to hit the first tanker. Each member of the flight would top-off with about 800 lbs. of fuel just to ensure the fuel tanks were operating properly. Aircraft with defective fuel tanks would have to be identified and abort the mission prior to heading out over the Pacific.

ACROSS THE BIG POND

Travelling at 460 knots, the trans-Pacific leg into Kadena AB on Okinawa took about eight hours. Since taking off at Elmendorff the F-15s had logged 3,900 miles before going wheels down at Kadena. Both men and machines were in need of rest. Maintenance crews would be flying into Kadena on C-141 Starlifters in the next several hours. In the meantime, the drivers and back-seaters would be catching up on some well-deserved sleep. Before long they would be making the short hop to Osan AB, South Korea.

In the interim, relations between the U.S. and North Korea had been steadily deteriorating. The National Security Council (NSC) and Joint Chiefs had reached a general consensus concerning North Korean sales of nuclear weapons to Iraq. If necessary, the U.S. would resort to ground strikes on North Korean nuclear facilities to prevent the transfer of nuclear hardware.

Word out of the CIA's Vint Hill Farms complex was that Kim was going to attempt another transfer in the near future. Having failed by sea, this second transfer according to sources would probably take place by air, making interception somewhat more difficult. Impromptu think tanks tried to address the obvious questions. What if the warhead was secretly placed aboard a civilian airliner along with passengers? How do you stop and search a passenger jet? And finally, would the U.S. shoot down a plane loaded with civilians to prevent Iraq from obtaining a nuclear weapon?

A RETURN TO MIG ALLEY

The President was left with no alternative but to authorize a series of airstrikes on North Korean nuclear installations, ports and selected airfields. The Yongbyon processing plant in particular would have to be taken out. The 335th Squadron's Strike Eagles at Osan were put on alert. At any minute the call would come through to begin hitting predetermined targets. After all these years, the Chiefs will be returning to "MiG Alley" once again.

KOREAN COMMENTARY

The first Korean War took place in an era far removed from the type of aerial combat you will experience in F-15 Strike Eagle III. There were no long-range engagements. Everything was done up close and personal. Air-to-air missiles and precision guided ordnance had yet to make their debut. In fact, the majority of bombing raids were conducted by aircraft with piston-driven engines, remnants of the last major war. Even the venerable P-51 Mustang of WW II was a common sight over North Korea early in the war.

The war did provide the venue for a classic confrontation, reminding one of the World War II duel between German Me-109s and British Spitfires. The F-86 and MiG-15, two evenly matched fighters, became locked in a lethal air battle with the prize being air supremacy over Korea. While neither aircraft could claim a significant advantage over the other, each had its own unique set of characteristics which could potentially give it an edge in a dogfight.

Aerial combat in the 1950s was almost exclusively a "stick and rudder" affair with guns thrown in. It was actually more akin to the last aerial battles in WW II than the first battles of the jet age. With both sides possessing similar aircraft, aerial combat was often decided by the individual skills of the pilots.

In *F-15 Strike Eagle III's* Korean War scenario, you are required to revisit many of the same targets struck during the 1950s. This time, however, you face significant threats that the earlier pilots did not. Since the Fifties, North Korea has purchased a substantial amount of SAMs and has invested heavily in triple-A guns. Not only are the air defenses better equipped but the air force is much improved. Its pilots are far better trained the "recruit pilots" which flew the MiG-15s.

Staging from South Korean bases, your F-15E is required to penetrate the heart of the enemy's air defenses. Lavishly equipped with SAMs, North Korea can best be described as treacherous. Rugged North Korean terrain, with its numerous peaks and valleys, makes flying more difficult yet provides a sanctuary for you to hide in. An experienced pilot can shake a missile "lock" in a hurry by using terrain properly.

NORTH KOREAN ORDER OF BATTLE

GROUND FORCES:

2 Armored divisions, 5 Mechanized Infantry divisions, 31 Infantry divisions, 6 Armored brigades, 4 Artillery brigades, 20 Artillery regiments, 5 Airborne battalions

Major Equipment: (3,500) MBTs T54/55/62s, PT-76s, Type 62s, (2,000) APCs BTR40/50/60/152s, BMP-1s, (3,500) artillery pieces incl. 122mm and 152mm SPA

AIR FORCE:

3 Light Bomber squadrons, 10 F/GA squadrons, 12 Interceptor squadrons, 3 Transport squadrons, 7 Training squadrons

Major Equipment: (50) IL-28, (30) SU-7, (10) SU-25, (50) MiG-19, (58) MiG-23, (48) MiG-29, (40) A-5 Fantan, (200) An-2, (10) An-24

NAVAL FORCES:

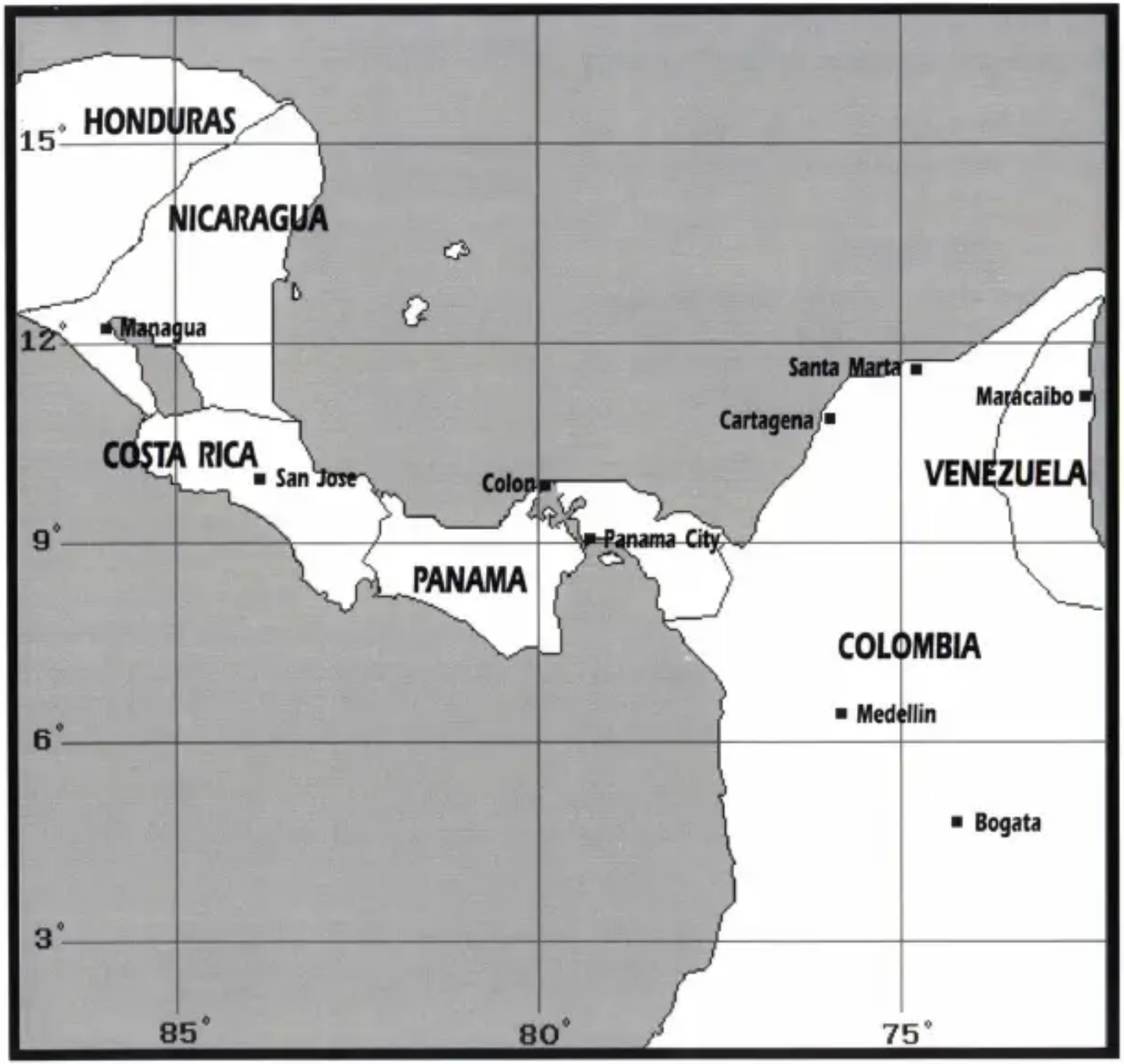
(2) Najin class Frigates, (1) Soho class Frigates, (16) Romeo class Submarines, (4) Whiskey class Submarines, (4) Soju class FACs (improved Osa), (12) Osa Is

AIR DEFENSES:

2 SAM divisions, 5 SSM regiments

Major Equipment: 50) SA-2, (30) SA-3, (54) SA-5

THEATER MAP – PANAMA



III. CENTRAL AMERICA SCENARIO

"A MAN, A PLAN, A CANAL; PANAMA"

Prior to the 20th century, Panama had been just a distant province of Colombia, separated from the rest of the country by mountains and jungle. But the proposed construction of a trans-oceanic canal through the region had made it a very desirable piece of property. Linking the Atlantic and Pacific oceans, the Panama Canal would make the lengthy voyage around South America's Cape Horn unnecessary.

The benefit of such a short cut was driven home during the Spanish-American war when the battleship *USS Oregon* had to sail around South America in order to join the U.S. fleet off Cuba. The *Oregon* had been instrumental in providing America's margin of victory in the Battle of Santiago. The military usefulness of such a link thus demonstrated, commercial transportation costs would also be cut dramatically by shortening the length of time goods spent at sea.

A French engineering firm had been awarded the contract to complete the canal in the 1880s. But after six years and the death of 20,000 workers due to disease, the company abandoned the effort. Asking for over $100 million to cover its expenses, French investors put the unfinished canal up for sale. The United States quickly expressed an interest but at the same time entered into negotiations concerning an alternate route through Nicaragua.

Faced with this new competition, the French firm decided to cut its losses and lowered its offer to only $40 million. The United States, which had not been discouraged by the French failure, accepted this lowered asking price. However, if Americans were going to build the canal, we were equally determined to own it.

Even at $40 million, the Panama route was expensive when one considers the $15 million paid for the whole of the Louisiana territory, or $7,200,000 paid for Alaska. The United States opened a round of negotiations with Colombian authorities seeking to create a six mile wide Canal Zone. In 1903, the Hay-Herran treaty formally gave the U.S. rights to the Canal Zone for $10 million down and $250,000 a year in rent. After the pact was concluded, Colombian officials decided to up the price to $25 million.

Referring to those "*foolish and homicidal corruptionists in Bogota*," rough-riding Theodore Roosevelt flew into a rage. Now acting as President as a result of McKinley's assassination in 1901, Roosevelt was determined to have the canal. Having won fame in the Caribbean for his charge up San Juan Hill, he was used to confrontational tactics with Latin Americans.

In a display of chicanery unparalleled since the Mexican-American war, Roosevelt engineered an uprising in the port of Colon against Colombian officials. Headquarters for this "people's revolt" was Room 1162 of the New York Waldorf-Astoria hotel, an unlikely spot for Colombian revolutionaries to meet. It was here that the conspirators raised money to secure Panama's independence from Colombia. The revolution

FLYING DANGER-CLOSE OVER PANAMA CITY

was led by a number of former Colombian soldiers in the pay of the certain U.S. citizens. In case Bogota protested, the navy cruiser *USS Nashville* just happened to be on hand.

Not only did Colombia protest but it tried to send military forces into Panama to reclaim it. Unfortunately, an impenetrable jungle stood in the way and U.S. warships were in position to interfere with any move up the coast.

A civil war in Colombia had ended just prior to the Panamanian revolt. Known as the *War of a Thousand Days*, it had cost the military over 10,000 lives. Consequently, Colombia was in no shape to confront the U.S. on this issue and in the end was forced to recognize the independence of its former province.

"Tell them that I am going to make the dirt fly."
— Theodore Roosevelt in 1903

The revolt had been successful. After placing hand-picked Panamanian officials in power Roosevelt signed a treaty giving the U.S. rights to the canal in perpetuity. For $10 million down and $250,000 a year (terms of the original deal with Colombia), the U.S. had gotten its bargain after all. The canal was built ahead of schedule and by coincidence was opened for business only days after the start of World War I in 1914.

The unsavory manner in which Roosevelt obtained the Canal Zone never sat well with American ideals of fair play. When asked by Roosevelt himself to defend the President's actions, Attorney General Philander C. Knox responding, "Oh, Mr. President, do not let so great an achievement suffer from any taint of legality."

Though ownership of the Canal had been crucial to the conduct of our two-ocean war strategy in World War II, it still had a certain stigma attached to it. Continued possession lent credence to Latino charges of Yanqui imperialism and tainted relations with our hemispheric neighbors.

"We stole it fair and square, so why can't we keep it?"
— U.S. Senator during the 1977 debates

Serious consideration over the return of the canal to Panama began during the Carter administration in the late 1970s. President Jimmy Carter and fellow Democrats pushed hard for Senate ratification of the Panama Canal Treaty which would relinquish control of the canal in 1999. The debate was divisive. Republicans charged the Democrats with being soft on foreign policy but in the end the treaty managed to squeezed through passage. The 1977 Panama Canal Treaty was now law, committing the United States to return the Canal Zone to Panama by 31 December 1999.

OPERATION "JUST CAUSE"

In 1989, after invoking the right of "self defense" clause contained in the treaty, the United States launched "Operation Just Cause." Just Cause came in response to repeated harassment of U.S. citizens, military and civilian, within the Zone. But the underlying goal of the operation was the capture of Panama's "Maximum Leader" General Manuel Antonio Noriega. Noriega had been a one-time CIA paid informant but lately the U.S. had linked him to illicit drug trafficking.

Over a five-day period General Noriega had managed to elude over 20,000 U.S. servicemen by making his way to the Vatican embassy in Panama City. Fed a diet of steady high volume rock 'n roll music by members of the 82nd Airborne Division, Noriega finally surrendered to U.S. authorities. He was immediately whisked away to eventually stand trial for various crimes including dealing in narcotics.

In the decade following the ouster of strongman and CIA confidant, Manuel Noriega, much has happened to the former Republic of Panama. A succession of civilian governments, all enjoying tacit U.S. approval, have failed due to rampant inflation and stagnant national economy. The support promised by the United States in the wake of General Noriega's departure did not materialize. With severe budgetary problems of its own, the United States was forced to curtail many of its foreign aid programs. Panama, never high on anyone's list to begin with, was dropped entirely.

As a result, Panama became a nation adrift. Burdened by a mounting national debt and nonexistent middle class, the tiny country descended into chaos. The few fortunate souls with means took their money and their families out of the country. Those remaining behind were mainly native mestizos. With no hope for the future a generation of poor grew up just outside governmental installations, subsisting on occasional handouts or scrounging through military refuse. The only source of steady income still open was plantation work on land owned by a few large corporations.

Obligated by treaty to turn over control of the Canal Zone, the United States was alarmed by what it saw happening in Panama. In secret Congressional deliberations, National Security Counsel (NSC) staffers testified in favor of postponing the return of the canal area indefinitely.

Citing unrest and the potential for terrorist activity, the NSC called for, "*...the removal of all military forces from the region or reinforcing those forces already in theater to degree commensurate with the level of violence.*"

Civilian officials in the State Department had also taken a pessimistic tone, summing up their findings by concluding, "*...an intolerable situation exists in which elected representatives in Panama are unlikely to exercise positive control over the Canal proper and its environs in the future.*"

THE YANQUIS GO HOME

Despite these dire predictions, the President ignored the warnings of this cabinet officials and dutifully carried out the letter of the treaty. The 193rd Infantry Brigade was removed from the Canal Zone accompanied by much public fanfare. Panama rejoiced over the proceedings as the Stars and Stripes was hauled down from Albrook Air Base for the last time. All U.S. Army personnel were redeployed back to the states while the Air Force sent its people to other overseas locations.

Months ahead of the required date the Canal Zone was for the first time in its history sovereign territory of the Panamanian republic. As the glow of celebration died down, the responsibility stemming from ownership began to sink in. The Canal had never been profitable since it began operating in 1914. It had survived year after year only as a result of huge U.S. subsidies. Whether Panama could now afford its prize possession remained an open question.

THE "LEBANON-IZATION" OF PANAMA

The social divide separating rich from poor in Panama resulted in the formation of very distinct political castes. The peasant class, which had originally banded together for economic survival, wound up fragmenting into a system of regional alliances. As the these ties grew, a more structured and formalized system of family loyalties emerged. As this fragmentation progressed, Panamanian society began to rely far less heavily on its central government.

Largely seen as a tool of northern imperialism, the government lacked both credibility and relevance. It was as if no one was paying attention any longer. As the various clans gained strength, they evolved into something closely resembling large fraternities. Though there were strong similarities between the clans and organized crime in the U.S. it would be wrong to make too much of this analogy. The Panamanian peasants gathered more to present a solid political front against exploitation than to engage sinister activities.

In a less anarchic state these groups might even been considered political parties. But, because the central government had to ceased to function effectively, there was no point in running for elective office. No one group could hope to win enough converts from the others to achieve anything close a national concensus. The break down in government led to a situation where the clans began exercising un-checked power. Recognizing no law higher than their own each group had taken part in the de facto dismantling of the country. A new period in Panamanian history was dawning, the country was becoming "Lebanon-ized."

"BARRIO BEIRUT"; PANAMANIAN CIVIL WAR

A crisis was brewing that even Americans working in the Zone could detect. The nickname "Barrio Beirut" came into popular use when referring to Panama City. In deference to the U.S. involvement in Southeast Asia, military retirees began tooling around the city with bumper-stickers reading "PANA-NAM." Luckily for them, perhaps, the locals weren't hip to the humor.

It is hard to pinpoint the exact moment when civil war broke out in Panama. There were never any declarations just a noticeable increase in the level of violence. As wars go, this one was fought more as a series of grudges. One faction would pick a fight with another over some perceived insult, either real or imagined. For the next few weeks both sides would bang away at each other and then things would go pretty much back to "normal."

Torn by civil strife, it wasn't long before outside influences began making inroads. The country was overrun by small groups of Cuban socialists, Peruvian-Marxists, right-wing totalitarians, hemispherists, and radicals of every conceivable political bent. But on the heels of this

ideological stew came a more insidious intrusion. Intent on opening new drug routes to the United States, *narco-trafficantes* flocked to the lawless "Wild West" atmosphere of Panama's steaming jungles.

"LITTLE COLOMBIA"

South American drug cartels looked upon Panama as an ideal spot from which to operate. In the days when Noriega was in charge, Colombian drug lords had paid a high sum in brides to use its facilities. Dirt strip runways abounded in areas which were otherwise inaccessible. Now, with routes already established, these same smugglers could open shop in jungle clearings for nothing. In fact, using their huge profits they could recruit battalions of impoverished natives as guards. Motivated by a desire to provide a decent life for their families these men willingly participated in the drug trade. What choice did they have other than watching their children slowly starve?

Within several years, drug activity through Panama became pandemic. Marijuana grown in clandestine fields competed with the jungle laboratories producing cocaine slag from Peruvian leaves. The Chucunaque river valley in eastern Panama became so infested with cocaine processing camps it became known as "Little Colombia." Nestled snugly between two mountain ranges, del Darien and de Canazas, to Drug Enforcement Agency (DEA) men, Little Colombia was Panama's *A-Shau* Valley.

Despite the U.S. declaration of war on drugs, very little had actually been accomplished. The reluctance to train and use military personnel in this war had crippled the effort. More importantly the DEA's high-handed tactics had alienated the very foreign governments it depended on for help. The U.S. Supreme Court decision in 1992 to allow the kidnapping and extradition of wanted persons from foreign countries had not played well in South American capitals. The intrusive nature of America's "War on Drugs" had driven relations to a new low, worse even, than during the Falkland-Malvinas conflict.

The Colombian government in particular had been extremely upset by this policy and warned the U.S. against conducting such operations on its territory. As might be expected, DEA agents in Bogota and Medellin began to get rather frosty receptions from government officials. In Peru and Venezuela, cooperation in the drug war had never progressed much beyond lip service, even before the Supreme Court's announcement. Relations between countries were further poisoned by the "accidental" attack on a P-3 Orion aircraft by a Peruvian Air Force jet, also in 1992. U.S. agents were being asked leave South America and escorted to the border by host-nation police.

As worrisome as the situation in Panama was to the United States, Colombia was even more concerned. For a long time officials in Bogota had been turning a blind eye towards the drug related activities of its citizens within Panama. But while Bogota was well aware of Little Colombia, it could not overlook the fact that Panama also provided a safe haven for the terrorist organization, M-19.

M-19 (APRIL 19TH MOVEMENT)

M-19 made its first appearance during the early 1970s. Since then, it has waged a bloody terrorist campaign aimed at overthrowing the Colombian government. The group became famous for its theft of the priceless sword of Bolivar, the George Washington of South America. During the 1976 elections, M-19 gained a reputation for ruthlessness by kidnapping and murdering a local labor union leader. Then in 1980, the group staged a takeover of the Dominican Republic's Colombian embassy. With increased notoriety came support from Cuba. Throughout the eighties, Castro allegedly provided arms and terrorist training to the subversives causing Bogota to severe diplomatic relations.

Using the arms and equipment obtained from Cuba, M-19 conducted its most famous operation to date. In 1985, 24 of its members captured the Palace of Justice in Bogota. During the two day siege which followed, the terrorists murdered the supreme court justices they had found inside. The military was called in and finally retook the building but only after more than 100 people were killed. The exploit electrified the nation.

The Colombian government responded by declaring an "all-out offensive" on terrorism which continued into the mid-1990s. It reluctantly made concessions to various drug barons in return for money and assistance. Their effort paid off. Within months, Colombia was successful in disrupting M-19 within its own borders. Cells were broken up, arms caches discovered and soon the group was out of the terrorist business. Recognizing the extent of their defeat, surviving members of the group surrendered to authorities.

With their weapons turned in, M-19 could no longer use terror as a means of persuasion. Over the next several years the group worked on repairing its image and sought to join the legitimate political process. Unfortunately, their brand of totalitarian socialism was no more palatable even when presented peacefully. The people of Colombia were not about to adopt anything remotely resembling communism, not after watching the Soviet Union implode during the 1990s.

Before long, ideological firebrands within the M-19 organization were once again advocating a return to violence. Clearly, the country would not become socialist through normal methods. Turning again to Cuba for support, M-19 discarded any pretense of legitimacy. Legal means were just too slow when the country could be won by force of arms. Gathering its membership among young Cuban idealists and disaffected Colombian migrants, the group was back in the terrorist business.

Not ready to challenge the government on its own soil, the guerillas found the unrest in Panama to be perfect cover. Having been driven out of Colombia once, they established a network of jungle base camps just over the border. From these camps they were able to resume their terrorist campaigns within a very short time. In fact much of Colombia northwest of the Rio Atrato was soon under their influence.

COLOMBIA'S MASTER STROKE

Using the destruction of M-19's border sanctuaries as a pretense, Colombia has mounted a major land-sea-air campaign into eastern Panama. Prepared texts were sent out after the operation was underway to all O.A.S. member states, including the United States. By comparing this operation to Israel's 1982 "Peace for Galilee" campaign, Colombia was trying to minimize unfavorable public opinion. According to the statement, Bogota viewed the incursion as a temporary measure only. Its forces would be withdrawn immediately upon completion of the operation.

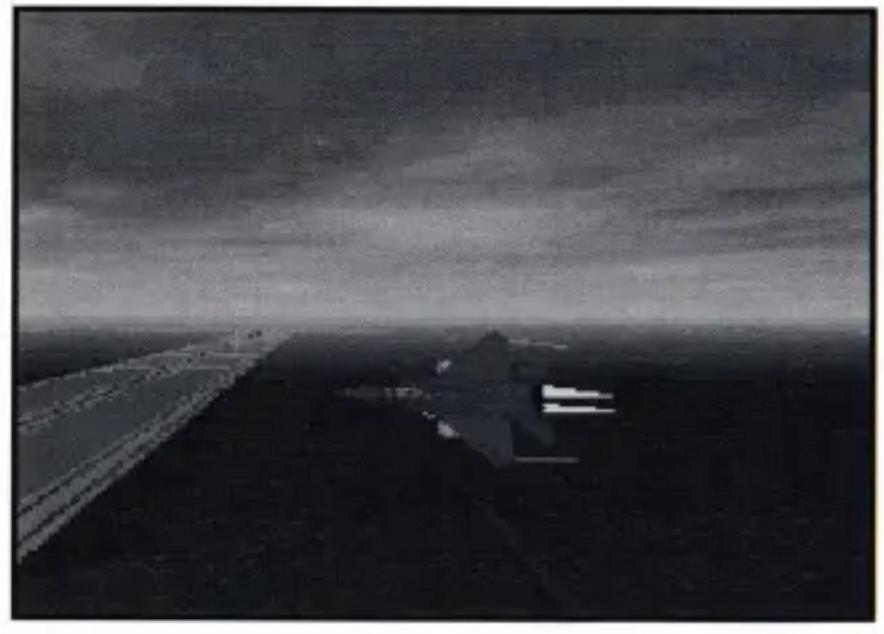
By any standards the operation was deftly handled. Naval units from the port of Buenaventura on Colombia's pacific coast disembarked a battalion of naval infantry at the mouth of the Rio Tuira. Upon landing the marine unit headed inland to the InterAmerican highway where they would be in position to intercept any M-19 guerillas retreating northward.

On the ground, units of Colombia's 3rd Division had left their billets in Calli the day before. Pushing north up the highway, the 3rd Division's two mechanized brigades became the hammer against the marine battalion's anvil. True, the units were only equipped with M4A3 Sherman tanks, but if all went well the guerillas would be destroyed by two squadrons of A-37s waiting overhead.

As the operation unfolded Colombian Rangers and Special Forces were airlifted deep into Panama. Riding in UH-1s and their new UH-60 Blackhawks, these troops were to secure key bridges and other strategic points along the InterAmerican highway. For example, an entire company of Rangers was inserted next to the bridge connecting both sides of Lake Bayano. The mission of these airmobile troops was actually two-fold, preventing guerillas from escaping to the Canal Zone and preventing outside forces (possibly U.S.) from interfering.

Flying Combat Air Patrol (CAP) over the entire operation were twenty-plus Mirage IIIs and 5s. Pilots were told not to expect interference from Panamanian F-5 interceptors in the Canal zone but were warned to

HIGH-G TURN OVER THE CANAL



stay alert nonetheless. The Colombian jets circled along the border in long, lazy, oval patterns being careful not provoke any reaction from Fort Howard.

For the United States, Colombia's abrupt decision to invade eastern Panama had placed it in a delicate situation. One the one hand, the security of Panama was still largely a U.S. responsibility. But, upon reflection, the U.S. was guilty of resorting to the same thing in 1989, using force to remove terrorism in the form of Noreiga. How could the United States protest a Colombian operation aimed at ridding itself of a communist terror organization? It couldn't. Like it or not, the U.S. was trapped in the logic of its own policies. The momentary indecision cost the U.S. the opportunity to keep the Colombians out of the Canal Zone.

As efficient as the Colombians were, the operation failed to encircle the M-19 units. The guerillas had been tipped off by their undercover agents still in government. By picking up and moving their jungle camps deeper and farther west into Panama, they were able to elude the Colombian assault. Though the Colombian armored units rolling up the highway didn't yet know it, but they were throwing their best punch into thin air. Still, Colombian troops would soon be in control of most of eastern Panama. The fact that nothing had been heard from the Americans was encouraging.

COLOMBIA STRIKES THE CANAL

Very few guerrillas were captured during the initial phase of the Colombian operation. Aerial observation detected that many members of M-19 were heading for Panama City. Colombian mechanized units headed out of their bivouac cantonment near Lake Bayano. Moving at a high rate of speed for the canal, more than one hapless civilian lay crushed beneath their treads. Publicly it would be announced that these units were still engaged in rooting out the fleeing members of M-19. Privately, Colombian military officers had already decided to wrest control of the Canal Zone from Panama.

After the American invasion in 1989, the Panamanian Defense Force (PDF) was disbanded. Also disarmed were Noriega's "Dignity Battalions," Panama's local militia comprised of little more than street toughs and thugs. In place of the Dignity Battalions a new military infrastructure had been created. In reality these changes were only cosmetic. The Panamanian military after 1990 was largely an army consisting of administrative headquarters.

Having inherited excellent airbases from the Americans after their departure, the Panamanian Air Force had no planes to fly. The Navy consisted of a few LSTs and patrol craft. But with nowhere to go and hardly any troops to transport, it spent all of its time at anchor.

So while the 11,000 man Panamanian police force constituted the major opposition to Colombia, it could hardly be expected to hold the advancing armor for long. With the country in the midst of civil war, it had its hands full trying to maintain order in the first place. Since certain factions were actively assisting the Colombian military, prospects for halting their offensive were nil.

On the northern end of the Canal Zone, a protracted firefight was in full swing. Seeking to carve up the port of Colon, Colombian drug barons sent members of their private army into the streets to drive out loyal Panamanian police units. Outnumbered and outgunned, the police evacuated the city after several days, leaving it to the hired mercenaries.

What concerned Colombian military leaders the most was the possible intervention of U.S. air power. Although the decision to take on the United States was bitterly opposed by many junior officers, the ruling clique was solidly behind the plan. Having watched the performance of U.S. forces during the Gulf war spectacle, the generals still believed they could win.

BANKING ON THE "VIETNAM SYNDROME"

For one thing, Colombia was not a desert nation. The area was covered with dense jungle growth and towering mountains. A war in this region would be largely an infantry affair, nullifying American advantages in armored forces. It would not be the type of fast moving, hard-hitting war fought in the Middle East or Europe.

It was assumed that the United States would probably react strongly once satellite reconnaissance spotted tanks moving on the Canal Zone. But by the time U.S. forces could respond, Colombian forces would be firmly in possession of Panama and daring the U.S. to expend its "smart weaponry" in the dense jungle cover.

Fighting in Central and South America would be more akin to fighting in Vietnam. Colombian soldiers were considered some of the best trained light infantry in South America, if not the world. Having fought guerrilla

groups like, M-19, FARC and ELN for decades, the Colombian military could rightly lay claim to being battle-hardened. Its forces were superbly equipped and accustomed to jungle warfare just in case the U.S. was foolish enough to take them on in their own backyard.

Most importantly however, Colombia had friends in the region it could turn to for help. Whereas, Iraq had been militarily and diplomatically isolated by the world community, Colombia was not.

SEARCHING FOR ALLIES

In 1981, Colombia's elected president Julio Cesar Turbay Ayala had flatly stated, "...*in view of the uncertain future and danger that is threatening the Caribbean* ," Colombia had plans, "*to improve all its deterrent military equipment* ." In the 1980s and 1990s, Venezuela had been the danger he was speaking of. As a result, Turbay's rearmament program was specifically aimed at improving Colombia's conventional force deterrence. More recently however, the two countries have found cooperation more profitable than confrontation. Their economic policies have marched in lockstep for well over half a decade.

It had always been assumed that should a ground war break out with Venezuela, Colombia's coal rich Guajira peninsula would be the reason. Disputed ownership of the land had come close to touching off war many times late in the 20th Century. But in the spirit of the new Colombia-Venezuela relationship, profits from the Guajira mines were to be shared. As these strong economic ties were forged, military co-operation and exchange further lessened tensions. It had allowed the Colombian military to concentrate on combating internal guerillas while Venezuela would be spared the expense of a costly arms race.

The price for Colombian generosity came with potential strings attached. Under terms of the 1947 Rio Pact, South American nations were obligated to come to the aid of fellow co-signers should they be attacked. Colombian military officials had every intention of requesting assistance from their Venezuela counterparts should the U.S. decide to intervene on Panama's behalf.

Colombian officials were particularly interested in Venezuela's three fighter squadrons. Equipped with F-16As, Mirages, and F-5s, the 11th, 12th, 16th Interceptor/attack Squadrons would be necessary to deal with the potential U.S. carrier and land based air threat. OV-10s belonging to the 15th Special Operations Group based at Maracaibo would be indispensable for jungle operations.

With the eastern flank secure now that Venezuela was tentatively on board, Colombia now turned its attention to enlisting additional conspirators. Since waving a carrot in the form of Guajira coal had worked so well with Venezuela, the military decided to take the same approach with others in the region.

A high level Colombian delegation was hurriedly sent to Managua, Nicaragua's lakeside capital. In secret meetings with Sandinista military and governmental civilian leaders, the emissaries placed two specific proposals on the table. First, Colombia promised not to oppose Nicaragua's plan to construct a second trans-oceanic canal in the future. To Colombia, this was a major concession since most future business would be directed to a wider and more modern canal system.

Secondly, Colombia agreed to enter into talks concerning the islands of San Andres and Providencia off Nicaragua's eastern shore. In 1979, these two islands were the subject of a territorial dispute which intensified when Nicaragua reasserted its claims. Fearing a possible Sandinista effort to take the islands by force, Colombia constructed a major military base on San Andres. This facility, complete with airstrip, served as the naval headquarters for the Caribbean. Increased naval and air patrols near the island was meant to send a message to the Sandinistas; hands off.

The cost for future negotiations concerning island repatriation was cooperation in harassing any United States response to the Panamanian operation. Anticipating that the U.S. might try to stage land-based aircraft in Costa Rica, the Colombians wanted to pre-position their aircraft at Nicaragua's Bluefields airbase. From Bluefields, interceptor/attack squadrons were in easy striking distance of Costa Rica and would be astride U.S. sea lanes of communication (SLOC).

A BELATED RESPONSE

As columns of tanks snaked their way along the InterAmerican highway to Panama City, the Colombian ambassador was summoned to the State Department. Behind closed doors, he was subjected to a verbal harangue from the President and his advisors. The ambassador was unable to shed

any light on his government's actions and said nothing. In very undiplomatic terms, the U.S. president stated his administration's position and spelt out the repercussions if Colombia did not withdraw immediately.

The Colombian ambassador replied that before he could speak with authority he would first need to consult with members of his own government. He expressed his surprize at the level of American concern since his country was in effect ending Panama's civil war. Furthermore, Colombian troops stationed in Panama were likely to accomplish more in the war on drugs than had all the previous American administrations combined. By skillfully putting the best face on the situation, he had bought his country some additional time.

At about the same time the ambassador was being shown the door in Washington, the lead Colombian tanks were rolling bumper to bumper across the Bridge of the Americas. Scout jeeps fanned out to patrol Panama City's side streets while the main column of tanks proceeded down the Avenue of the Martyrs.

Unknowingly, the Colombian military had triggered a military response from the U.S. when they entered Panama City. The Bridge of the Americas west of Panama City had been designated as the tripwire. Once the Colombians crossed into the Canal Zone, the United States was locked into a unilateral military response.

CRISIS IN CENTRAL AMERICA

The initial reaction in any crisis management session is always, "Where are the carrier battlegroups?" In this instance only one of the 3rd Fleet's carriers was on station in the Caribbean. The Nimitz class *USS United States* was conducting tactical exercises off Puerto Rico when the invasion first took place. One additional carrier, the *USS Carl Vinson*, was off Long Island, New York. The two carriers plus their escorts were immediately ordered to rendezvous off Mexico's Yucatan peninsula before proceeding to Panama.

In the meantime, F-15E squadrons from Seymour-Johnson, North Carolina were put on alert. These aircraft were to undertake a major shuttle operation to Juan Santamaria International Airport outside of San Jose, Costa Rica. Staged from Costa Rica, F-15Es would be in striking distance of all of Panama and most of Colombia with only a single refueling.

With Colombian troops spilling into the Canal Zone, airstrikes were probably a foregone conclusion. The two carrier groups and their component aircraft would buy the U.S. some needed time to deploy additional land forces. It would be at least several days before the 82nd Airborne Division could be assembled. Undergoing desert training exercises near the southern tip of the Sinai peninsula, the 82nd would have to be refitted for a jungle environment.

The F-15Es in Costa Rica and the carrier-borne F/A-18 Hornets would have to bear the brunt of the initial action. The first task confronting them would be to establish air superiority over the Canal Zone before amphibious and airborne operations could commence.

The television media in the U.S. was quick to pick up a story out of the Pentagon concerning a bit of historical irony. The Nimitz class carrier *USS Theodore Roosevelt* happened to be in Norfolk repairing a minor problem with turbine vibration. The military had originally wanted it to join the *USS United States* instead of the *Vinson*. Located in Virginia it would have arrived in the area almost a day sooner. As the orders were being cut, a junior naval attache pointed out that Teddy Roosevelt had perhaps been the root cause of this crisis over a century ago. The orders were changed.

CENTRAL AMERICA COMMENTARY

Despite our best intentions, the United States has never been able to maintain a stable relationship with our southern neighbors. Tension has always existed between Latin America and the United States since this country's founding. It has been hard to get beyond accusations of exploitation, since the 19th century is rife with examples of American imperialism. Even sincere and legitimate concerns over the region are often dismissed as either "Yanqui interference" or "Big Brother-ism" by South American nations.

The controversy over acquiring the Panama canal is just one case which illustrates why there continues to be such a deep-seated suspicion of the United States. We are living with the legacy of "gunboat diplomacy." Having been pushed around as mere "banana republics" for so long, it only stands to reason that these nations might wish to band together against outsiders.

In this scenario the United States finds itself in a dilemna. It is trying to preserve Panamanian independence without becoming mired in another guerrilla war. After some diplomatic arm twisting, Costa Rica has graciously agreed to allow U.S. aircraft to stage missions from its territory.

The majority of F-15E missions will undoubtedly take place over Panama and northwestern Colombia. But watch out; rumor has it that Venezuela has joined forces with the Colombians. If true, we may wind up facing some of our own advanced equipment. The Venezuelan Air Force is known to possess F-16s. While the Venezuelan Falcons lack some of the modern avionics that are standard in our domestic models, they are still formidable dogfighters.

Nicaragua may become another possible participant in this conflict. Although our State Department is working overtime to convince Managua to stay neutral, no one knows how they will react. American airpower based right next door in Costa Rica may serve as a warning but it might also act like waving a red flag in front of a bull. The Nicaraguans may submit or they may charge in a reflex action.

The Panamanian Air Force was equipped with F-5s but it is unknown how many of these aircraft survived the civil war. It is also not known whether these aircraft, if they did survive, are supporting the Colombians or combating them. Determining the threat posed by the F-5s may come down to a case by case situation.

While judging South American intentions has always been difficult for our intelligence services, the military aspect of the campaign is relatively cut and dry. The Air Force has assigned F-15Es to strike a wide range of potential targets. From hidden jungle laboratories belonging to the drug cartel barons to communications centers in Bogota, hundreds of targets are about to be caught in a hail of "smart" bombs.

COLOMBIAN AND VENEZUELAN ORDER OF BATTLE

GROUND FORCES:

Colombia: (4) divisions w/ nine brigades, (9) Mechanized-Cavalry Groups, (2) marine battalions, (1) marine jungle battalion, (1) Jungle battalion, (1) Ranger battalion, (1) AAA battalion

Venezuela: (3) Infantry divisions, (1) Mechanized-Cavalry Division, (1) Armor division, (1) Jungle division, combat engineers and Ranger Battalion

Major Equipment:

Colombia: (30) M4A3 Shermans, (30) M3A1 Stuarts, (120) EE-9, (80) EE-11, (60) M3 halftracks

Venezuela: (90) AMX-30, (49) AMX-13, (100) EE-9, (80) V-100s

AIR FORCE:

Colombia: (2) Interceptor/Attack squadrons, (2) COIN squadrons, (1) Helicopter/Transport squadron

Venezuela: (3) Interceptor/Attack groups, (2) Special Operation groups, (2) Light Bomber groups

Major Equipment:

Colombia: (25) Kfirs, (45) Mirage III & 5s, (18) A-37s, (25) SA-315A, (24) UH-1, (25) MD500, (10) UH-60s

Venezuela: (21) Mirage IIIs & 5s, (20) F-5s, (25) F-16As, (15) OV-10s

NAVAL FORCES:

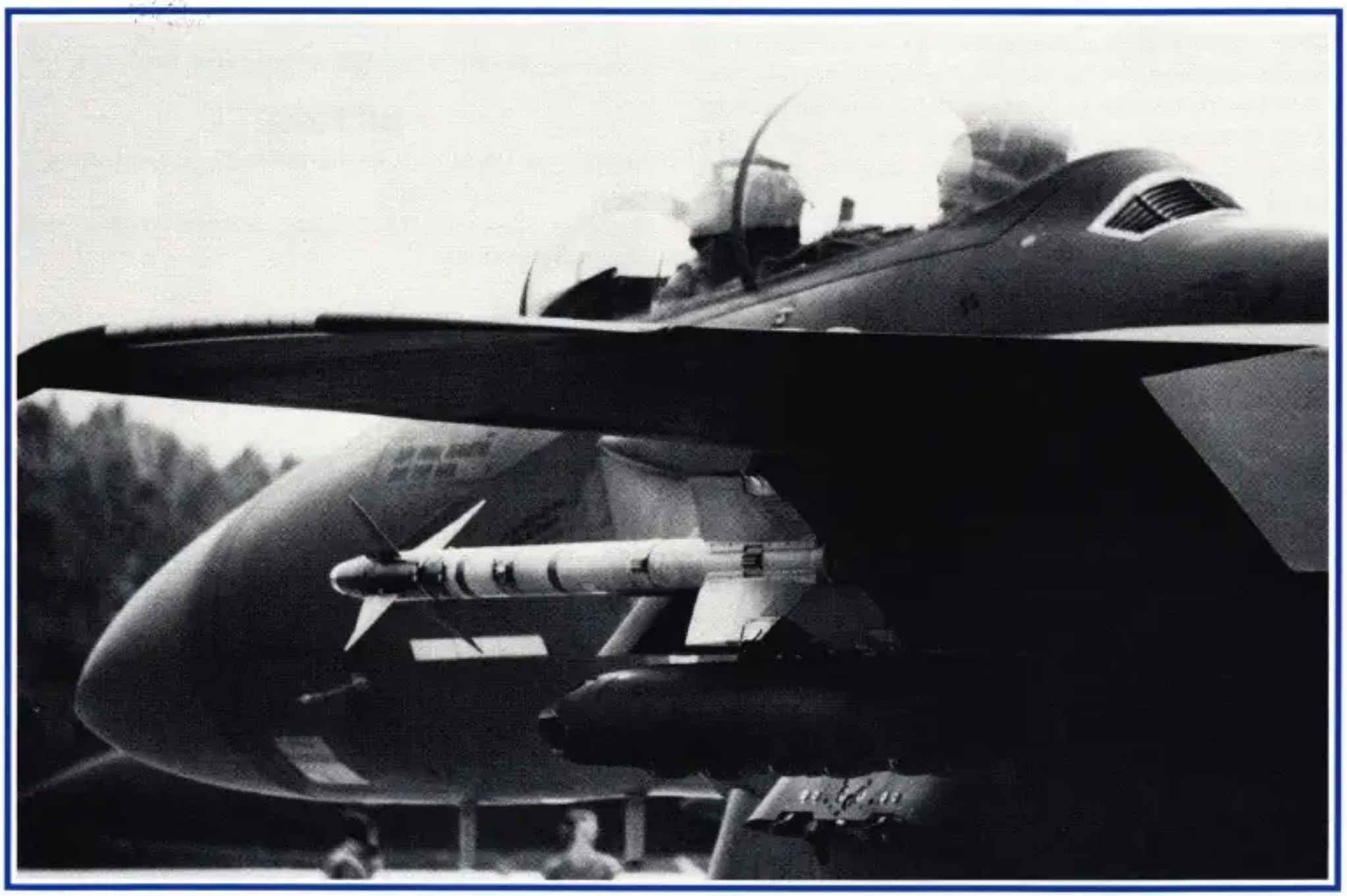
Colombia: (4) Type FS 1500 Frigates, (2) Type 209 Submarines, assorted gunboats and patrol craft

Venezuela: (6) Lupo class Frigates, (2) Coast Guard Frigates, (2) Type 209 Submarines, (6) Vosper FACs, (4) Cormoran FACs, (4) LSTs, assorted gunboats and patrol craft

AIR DEFENSES:

Colombia: small caliber triple-A guns only, recent discount purchases of Soviet equipment possible

Venezuela: small caliber triple-A guns, Roland-1, recent discount purchases of Soviet equipment possible



Hans Halbersstadt/Arm Communication

5. AIRCRAFT/ WEAPONS

DESCRIPTION KEY

Illustrations used in this section are not to scale. All abbreviations and scales used to describe the various aircraft and weapons systems in *F-15 Strike Eagle III* follow the same standard format;

Crew: normal complement needed to operate the equipment or vehicle, does not include passengers.

Engine: the type and number of engines normally used by the equipment or vehicle to produce power.

Maximum Speed: the maximum speed (in knots or mph for ground targets) attained by the equipment or vehicle at its normal combat weight, listings for aircraft are given for full military power at high altitude (greater than 36,000) without afterburners.

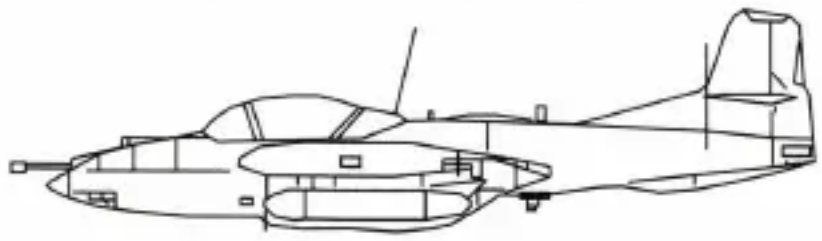
Gun: principle gun system listed by quantity, type and size of shell.

Sensors: principle radar, navigational and other detection systems normally used by the equipment or vehicle, either carried internally or in external pods.

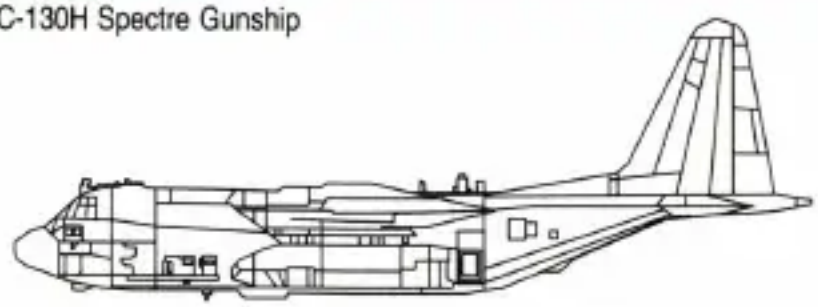
Ord (Ordnance): principle air to air and air to ground weaponry normally associated with the aircraft including bombs, rockets, and dispensers.

THREAT AIRCRAFT

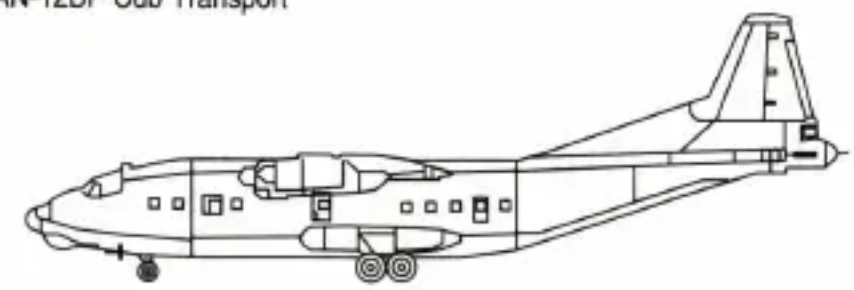
A-37 Dragonfly



AC-130H Spectre Gunship



AN-12BP Cub Transport



"BANDITS"

A-37 DRAGONFLY

The A-37 Dragonfly has a long and venerable career as a Counter-Insurgency (COIN) aircraft. First used by the USAF in South Vietnam, the A-37 has been exported to a number of South American countries. Based on the T-37 jet trainer, it has no specialized weapons systems. Up to 5,600 lbs. of ordnance may be carried on eight external pylons.

Crew:	2	Engine:	two GE J85-17A turbojets
Max Speed:	450	Gun:	1x GAU-2B/A 7.62mm minigun
Sensors:	commercial avionics only		
Ord:	rocket pods, bmbs		

AC-130H SPECTRE GUNSHIP

The Spectre is a specially modified C-130 Hercules featuring a sideways mounted 105mm gun, two 40mm cannons and a pair of Vulcan 20mm guns. The aircraft is also equipped with a low light TV system used for night operations. The AC-130H is used by both Columbia and Venezuela to augment their COIN squadrons.

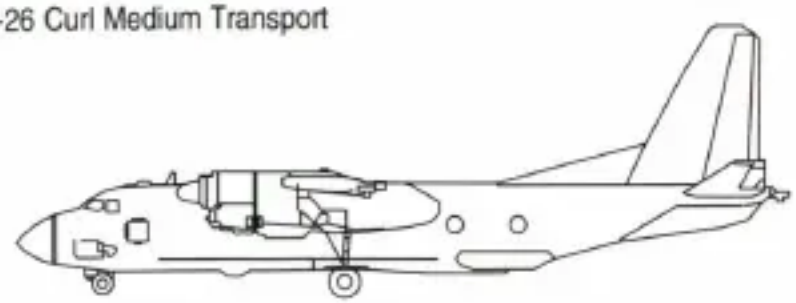
Crew:	5	Engine:	four Allison T56-A-15 turboprops
Max Speed:	340	Gun:	(see text)
Sensors:	standard Nav/Com suite, special fire control directors		
Ord:	None		

AN-12BP CUB TRANSPORT

The An-12 has been the Soviet Union's standard transport equivalent to the C-130. The Cub lacks a pressurized cabin which seriously limits its usefulness. Normally used as a cargo transport it may also carry up to 90 paratroopers in fold-down seating. It is widely used by Third World nations for its ability to operate from unprepared airstrips.

Crew:	6	Engine:	four Ivchenko AI-20K turboprops
Max Speed:	440	Gun:	2x NR-23mm guns (in tail)
Sensors:	commercial avionics		
Ord:	None		

AN-26 Curl Medium Transport

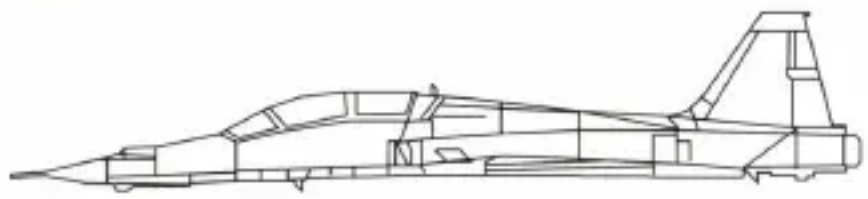


AN-26 CURL MEDIUM TRANSPORT

The Soviet Union's Antonov-26 was first shown in public at the 1969 Paris air show. The AN-26 is able to transport up to 12,000 lbs. of palletized cargo but it can also accommodate up to 40 passengers plus gear. It is equipped with an electric winch and conveyor system for rapid on/off loading. The AN-26 has been widely exported since its debut.

Crew:	5	Engine:	two Ivchenko AI-24VT turboprops
Max Speed:	340	Gun:	None
Sensors:	commercial avionics, OPN optical sight for cargo drop		
Ord:	None		

F-5 Tiger II

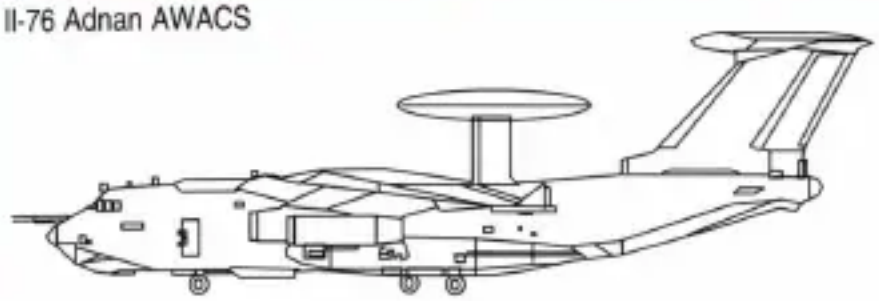


F-5 TIGER II

Developed for export by Northrop U.S.A., this single seat fighter is widely chosen by Third World nations. The F-5 is an economical, simple aircraft but lacks modern avionics. Never adopted for service by the USAF, it is used primarily to outfit U.S. "aggressor squadrons." Though underpowered, the small size of this aircraft makes it hard to detect visually in combat.

Crew:	1	Engine:	two GE J85 turbojets
Max Speed:	627	Gun:	2x M39A2 20mm guns
Sensors:	ALR-46 RWR, APQ-159 radar,		
Ord:	AIM-9, rocket pods, Gepod 30mm gun pod, Bmbs		

Il-76 Adnan AWACS

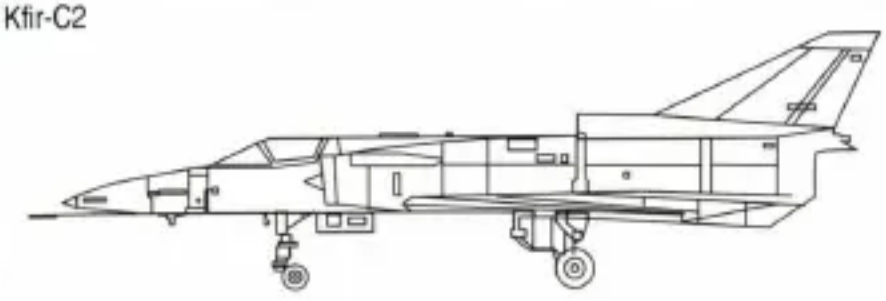


IL-76 ADNAN AWACS

Before the Persian Gulf War, Iraq converted three of its IL-76 transports in an effort to imitate the U.S. AWACS. Known as Adnans, these aircraft were equipped with French made Tiger G (SDA-G) radars. Not nearly as capable as even the Soviet Mainstay, these aircraft were little use to an airforce which didn't fly. Of the three, one escaped to Iran, one was destroyed on the ground and the third surrendered in mid-air.

Crew:	7	Engine:	four D-30KP turbofans
Max Speed:	480	Gun:	2x NR-23mm (in tail) guns
Sensors:	RWR, SDA-G, avionics for all-weather operations		
Ord:	None		

Kfir-C2

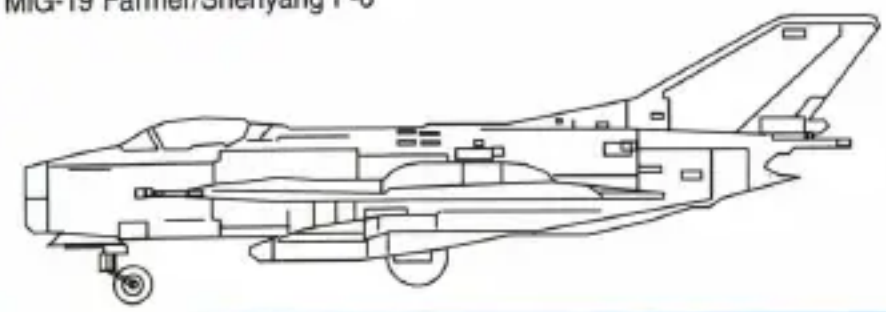


KFIR-C2

The Kfir is a copy of the French Mirage 5 with typical Israeli improvements. It features a General Electric J79 turbojet, a more powerful engine than the original production model Atar-9C. The Kfir-C7 is a two seat ground attack version with two additional fuselage hardpoints. Columbia currently has both C2 and C7 Kfirs in its inventory.

Crew:	1,(2)	Engine:	one GE J79-J1E turbojet
Max Speed:	780	Gun:	2x 30mm DEFA guns
Sensors:	RWR, Elta EL/M-2001 radar, SUU-25 IR pod, Elta ECM pod		
Ord:	AIM-7/9, Shrike, Maverick, rocket pods, bmbs		

MiG-19 Farmer/Shenyang F-6

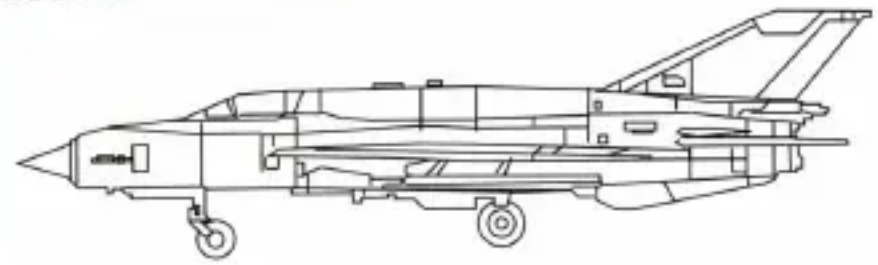


MIG-19 FARMER/SHENYANG F-6

The MiG-19 was first produced in appreciable numbers in 1955 and remained in production as late as 1980. It was the world's first fighter to break the sound barrier. Once early defects were corrected, the Farmer became the first Soviet fighter to be armed with air to air missiles.

Crew:	1	Engine:	two RD-9B turbojets
Max Speed:	570	Gun:	3x NR-30mm guns
Sensors:	RWR, Izmrud radar		
Ord:	AA-2, rocket pods, bmbs		

MiG-21PF/Jian F-7B Fishbed

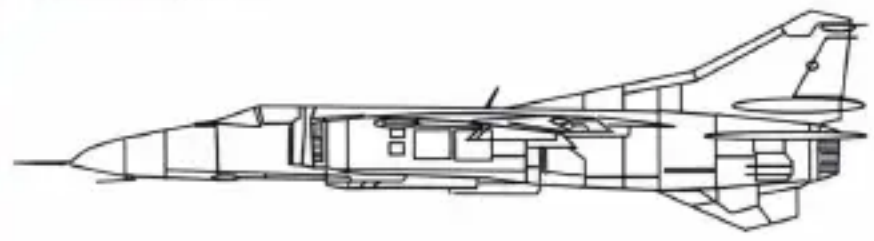


MIG-21PF/JIAN F-7B FISHBED

Known in Soviet circles as "Eagle," the MiG-21 was the premier Soviet dogfighter of the 1960s. The delta-winged aircraft suffers from limited avionics and a lack of all-weather capability. Soviet production of the MiG-21 has long ceased but many remain in inventory with Third World nations. The Chinese version, used by Iraq, is known as Jian-7.

Crew:	1	Engine:	one R-25 turbojet
Max Speed:	770	Gun:	1x GSh-23mm gun
Sensors:	RWR, Jay Bird radar,		
Ord:	AA-2/8, rocket pods, bmbs		

MiG-23ML Flogger-G



MIG-23ML FLOGGER-G

This Soviet built interceptor was produced in numbers approaching 600 per year making the basic unit cost extremely economical. It features a variable-geometry wing that is a complete departure from the MiG-21 design. The Flogger entered service in 1973 and remains a popular export.

Crew:	1	Engine:	one R-29B turbofan
Max Speed:	790	Gun:	1x GSh-23L 23mm gun
Sensors:	Sirena-3 RWR, Jay Bird radar, LRMTS		
Ord:	AS-7, AA-7/8/10/11, rocket pods, bmbs		

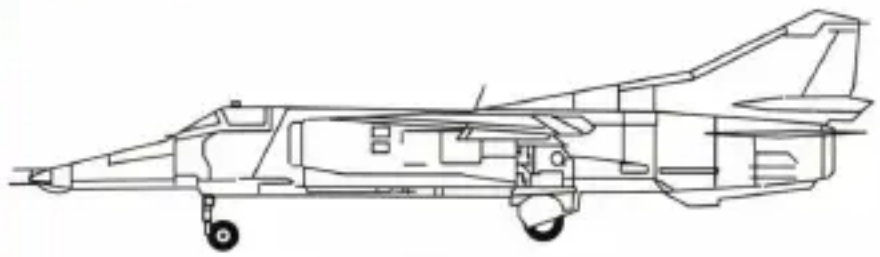
MiG-25M Foxbat-E

MIG-25M FOXBAT-E

The Foxbat caused quite a stir when it was first introduced. Designed as a strategic interceptor, it performs best only at very high altitudes. The MiG-25 was built for speed, not maneuverability. As a dogfighter this aircraft performs best at stand-off ranges rather than mixing it up in high-g turning battles. This aircraft is the *raison d'etre* for the F-15.

Crew:	1	Engine:	two R-31 turbojets
Max Speed:	830	Gun:	None
Sensors:	Sirena-3 RWR, High Lark radar, IRST		
Ord:	AA-6/7/8/11		

MiG-27 Flogger

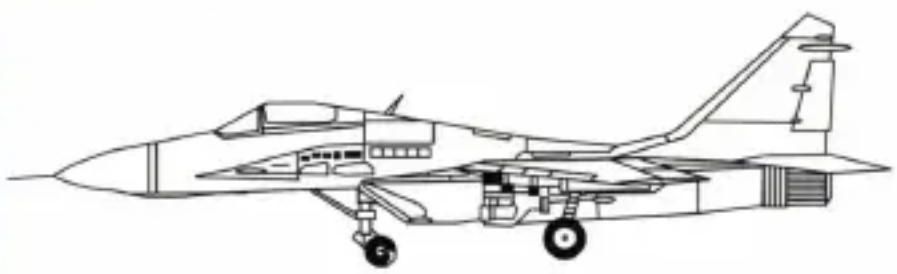


MIG-27 FLOGGER J

The Mig-27 is an air to ground variant of the MiG-23. The two aircraft are distinguishable only by the MiG-27's nose window which houses an air to ground radar. Another difference lies in the strengthened internal structure which is able to withstand higher g-forces. Although it lacks an all-weather capability, high production runs make this aircraft affordable .

Crew:	1	Engine:	one R-29 turbofan
Max Speed:	730	Gun:	1x GSh-6-N30mm gun
Sensors:	Sirena-3 RWR, NI-50M Doppler radar,		
Ord:	AS-12/14, AA-8, rocket pods, bmbs		

MiG-29 Fulcrum-A

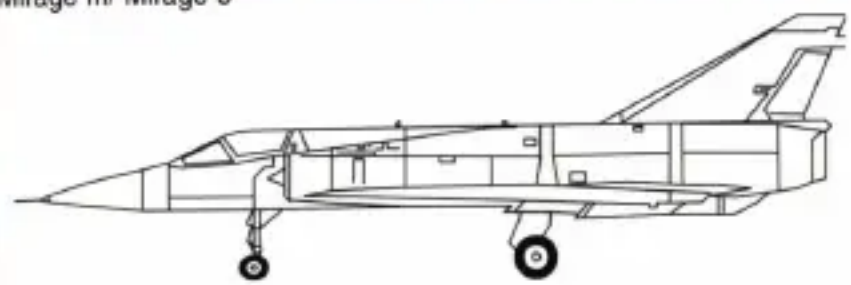


MIG-29 FULCRUM-A

The Fulcrum was designed specifically to counter the F-15 but comes up short. Possessing an excellent flight envelope, a MiG-29 in the right hands is an easy match for any F-16. It features impressive maneuverability and the capacity to sustain high-g turns. This is a top of the line aircraft though Iraqi pilots are still waiting to register their first F-15 kill.

Crew:	1	Engine:	two R-33D turbofans
Max Speed:	760	Gun:	1x 30mm(?) gun
Sensors:	RWR, Slot Back radar, IRST		
Ord:	AS-12/14, AA-10/11, one ECM pod, bmbs		

Mirage III/ Mirage 5

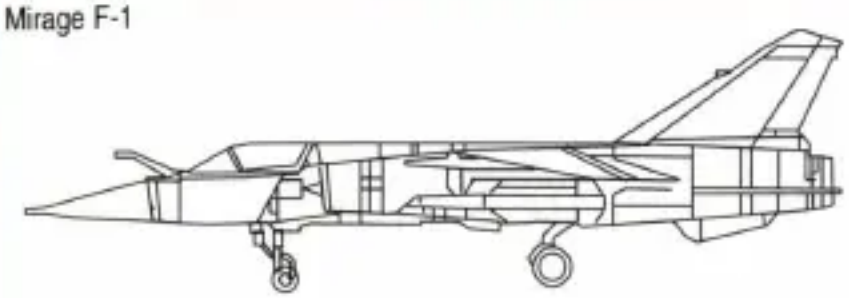


MIRAGE III/ MIRAGE 5

The Mirage III series began development in the mid 1950s as a high speed interceptor. The French Dassault firm received numerous orders from Third World nations impressed by the success achieved by Israeli pilots. The delta-wing design gives the aircraft high straight line speed but provides poor maneuverability in combat. The Mirage 5 features a more powerful navigational and attack system.

Crew:	1	Engine:	one Atar 9B turbojet
Max Speed:	770	Gun:	2x 30mm DEFA guns
Sensors:	RWR, Cyrano II radar (Cyrano IVM3 in Mir 5)		
Ord:	R.530, R.550 Magic, AS.37 Martel		

Mirage F-1

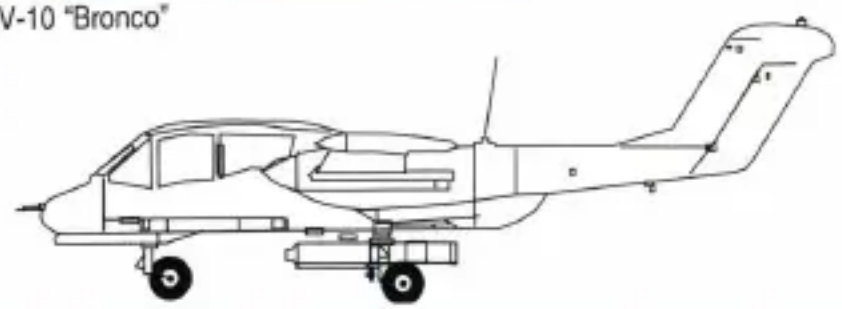


MIRAGE F-1

The French built Mirage F-1 represents a new generation in Dassault aircraft design. The F-1 features a departure from the familiar delta-wing configuration of the earlier Mirage series. The return to a more traditional wing design has created a more stable weapons platform for delivering ordnance at low levels. During the Gulf war, an Iraqi F-1 reportedly tracked an F-117A Stealth fighter with a searchlight.

Crew:	1	Engine:	one Atar 9k-50 turbojet
Max Speed:	783	Gun:	2x 30mm DEFA guns
Sensors:	RWR, Cyrano IVM radar		
Ord:	AM.39 Exocet, R.550 Magic, AS.30L, DB 3163 Jamming pods		

OV-10 "Bronco"

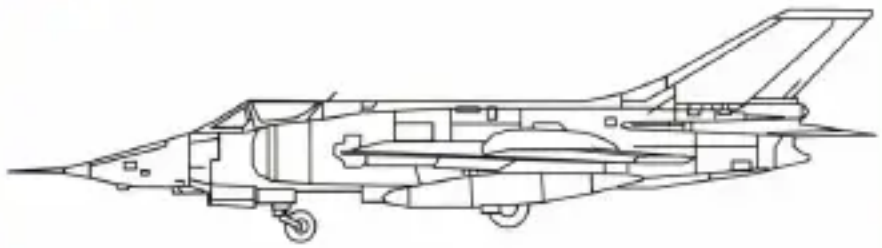


OV-10 "BRONCO"

The Bronco was designed as a COIN aircraft to be used in low intensity conflicts. Its main role is that of a FAC and reconnaissance platform. With an emphasis on observation, this lightly armed aircraft is unable to perform sustained operations in a high threat environment.

Crew:	2	Engine:	two T76-G-420 turboprops
Max Speed:	263	Gun:	2x 7.62mm Machineguns
Sensors:	AA/AAS-37 FLIR, APR-39 RWR, laser-designator		
Ord:	AIM-9, rocket pods, gun pods, bmb		

Qiangjiji-5 A-5 Fantan

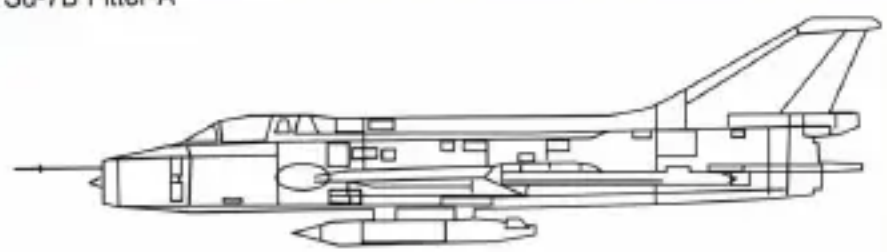


QIANGJIJI-5/A-5 FANTAN

This Chinese derivative of the MiG-19 has been adapted to perform in a ground strike role similar to the UK's Buccaneer. One unique feature of this aircraft is the use of an internal bomb-bay. Iraq had two squadrons of A-5 Fantans at the start of the Gulf War.

Crew:	1	Engine:	two Shenyang WP6 turbojets
Max Speed:	570	Gun:	2x NR-23mm guns
Sensors:	Type 930 RWR, High Fix radar		
Ord:	AA-2, R.550 Magic, rocket pods, bmbs		

Su-7B Fitter-A

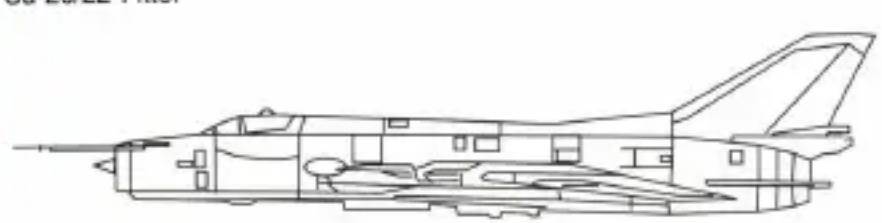


Su-7B FITTER-A

First flown back in 1955, the Fitter-A has been exported in great numbers to Soviet client states. Initially designed as a fighter to counter the USAF's F-100, the Su-7 was relegated to a ground attack role during the Six Day War over the Sinai in 1967. The major drawbacks to this aircraft are a limited payload capacity and short combat radius.

Crew:	1	Engine:	one AL-7F-1-100 turbojet
Max Speed:	770	Gun:	2x NR-30mm guns
Sensors:	Sirena-3 RWR, Odd Rods IFF		
Ord:	rocket pods, bmbs		

Su-20/22 Fitter

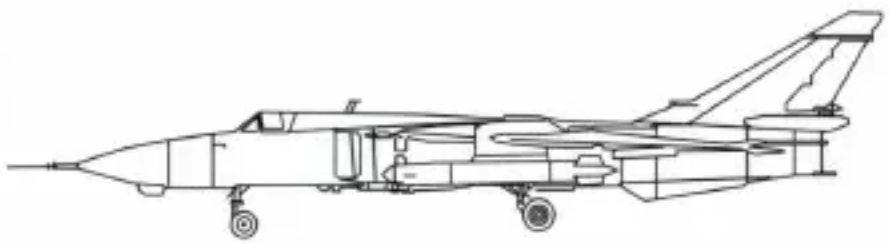


Su-20/22 FITTER

The designation Su-20/22 refers to the basic Soviet Su-17 model configured for export. This aircraft constitutes the majority of Iraq's long range ground attack capability with over 80 in inventory before the Gulf War. Two Su-22s were shot down by F-15s after the cease-fire while attacking Kurdish rebels in northern Iraq. The Su-20/22 remains suited solely for ground attack missions.

Crew:	1	Engine:	one R-29 turbojet
Max Speed:	770	Gun:	2x NR-30mm guns
Sensors:	RWR, High Fix radar, LRMTS, ASP-5ND fire control radar		
Ord:	AS-7/9/10, AA-8, rocket pods, bmbs		

Su-24 Fencer

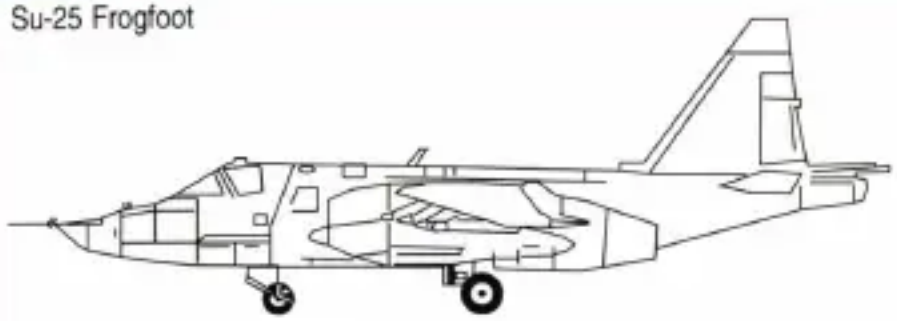


Su-24 FENCER

First deployed outside the Soviet Union in 1982, the Fencer is roughly equivalent to the USAF's F-111. It is an all-weather, deep strike aircraft able to deliver ordnance with a CEP of 180 feet. Packed nose to tail with advanced avionics, Su-24 remains somewhat of a mystery to western intelligence sources. It features a wide range of possible strike configurations.

Crew:	2	Engine:	two R-29 turbojets (?)
Max Speed:	760	Gun:	1x 23mm or 30mm gun
Sensors:	RWR, LRMTS, Terrain-following Radar, unknown radar,		
Ord:	AS-7/9/10/11/12/14, AA-8, rocket pods, bmbs		

Su-25 Frogfoot

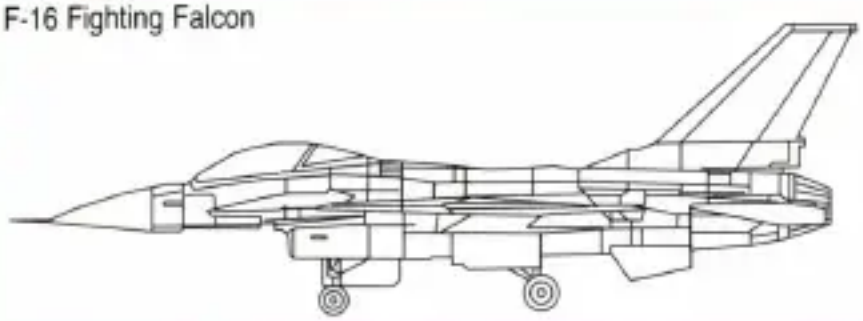


Su-25 FROGFOOT

The Su-25 entered service in 1984 as a counterpart to the A-10. The aircraft features a titanium bathtub cockpit to protect the pilot from ground fire during its low level missions. Soviet pilots have nicknamed this aircraft Grach (Rook). The Frogfoot is an extremely capable ground attack aircraft.

Crew:	1	Engine:	two R-13-300 turbojets
Max Speed:	480	Gun:	1x GSh-6-N30mm gun
Sensors:	RWR, LRMTS, laser designator		
Ord:	AS 7/9/11/12, AA-8, rocket pods, bmbs		

F-16 Fighting Falcon



F-16 FIGHTING FALCON

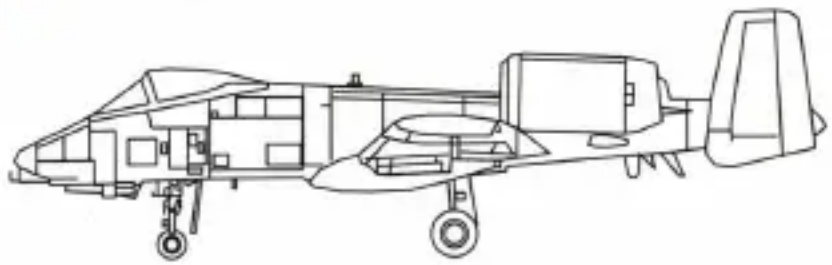
The problem with continued U.S. conventional arms sales is that the U.S. might one day have to face its own technology in combat. The danger of transferring military hardware to other countries is illustrated in the Central American scenario. The Venezuelan F-16s are still formidable adversaries despite the lack of certain avionics and can make life unpleasant for all but the most advanced U.S. aircraft.

Crew: 1		Engine: one F100-PW-220	
Max Speed: 770		Gun: 1x M61A1 20mm Vulcan	
Sensors: RWR, APG-68			
Ord: AIM-7/9L, rockets, bmbs,			

NON-THREAT AIRCRAFT

"FRIENDLIES"

A-10 Thunderbolt II

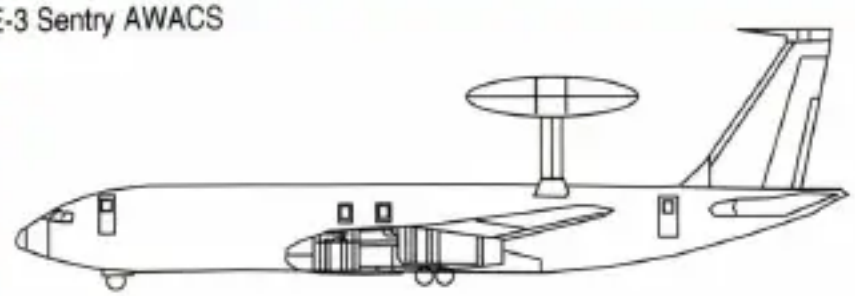


A-10 THUNDERBOLT II

Affectionately known as the "Warthog," the A-10A was designed in the early 1970s to be the ultimate tank killing aircraft. It was literally "the plane that was built around a gun." The A-10 features a titanium bathtub cockpit for pilot survivability. Future upgrades will include the addition of a LANTIRN pod.

Crew:	1	Engine:	two GE TF34-100 turbofans
Max Speed:	400	Gun:	1x GAU 30mm "Avenger" gun
Avionics:	ALQ-119, FLIR, RWR		
Ord:	Maverick, AIM-9L, Rockeye, GBU-15, GBU-10		

E-3 Sentry AWACS

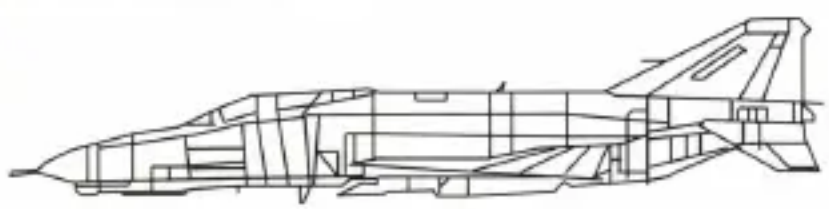


E-3 SENTRY AWACS

The E-3 Sentry AWACS is a modified Boeing 707 aircraft. It houses the world's most sophisticated airborne radar capable of handling multiple target detections. The Sentry is equipped with an IBM CC-1 high speed computer with a main storage capacity of over 650,000 words. Each technician is provided a monitoring console with tactical display.

Crew: (4) 13 technicians		Engine:	four PW TF33-100 turbofans
Max Speed:	480	Gun:	None
Sensors:	AN/APY-2 radar		
Ord:	None		

F-4G "Wild Weasel" Phantom II

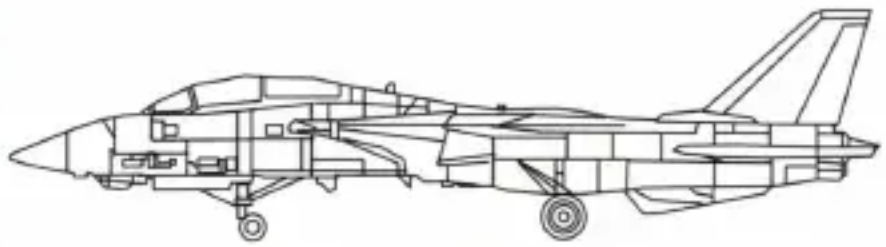


F-4G "WILD WEASEL" PHANTOM II

Although the F-4 is gradually being replaced by the F-15, the F-4G "Wild Weasel" was used extensively during the Gulf war for defense suppression. The two-seat F-4Gs hunted Iraqi radar emissions and used their special weaponry to destroy active sites. It takes a brave crew to go looking for trouble.

Crew:	2	Engine:	two GE J79-15 turbojets
Max Speed:	770	Gun:	1x 20mm Vulcan gun
Sensors:	RWR, APR-38 EW, APQ-100, ALR-46,		
Ord:	AIM-9L, AGM-45 Shrike, AGM-88 HARM, AGM-78 ARM		

F-14A Tomcat

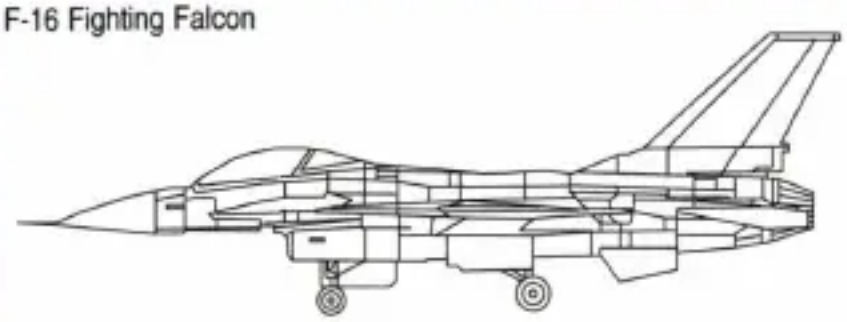


F-14A TOMCAT

Celebrated in the movie "Top Gun," the F-14 is the U.S Navy's principal carrier-borne interceptor. The two-seat aircraft has an extremely powerful AWG-9 radar system which allows the Tomcat to engage multiple targets up to 100 nm away. It normally carries the AIM-54 Phoenix radar guided missile.

Crew:	2	Engine:	two P&W TF30-412A turbofans
Max Speed:	775	Gun:	1x 20mm Vulcan gun
Sensors:	ALR-45 RWR, ALQ-100 DECM, ALE-39 Chaff pod, AWG-9,		
Ord:	AIM-7/9/54, AIM-120 AMRAAM		

F-16 Fighting Falcon

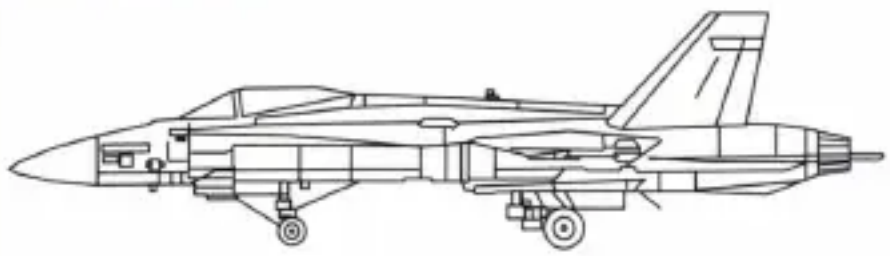


F-16 FIGHTING FALCON

The F-16 is considered by many to be the most maneuverable fighter in the world. Using "fly by wire" controls, the Falcon has been dubbed the "electric jet." As a result of frequent crashes during development and testing, pilots gave it the less flattering nickname "Lawn Dart." F-16s equipped with phosphorus rockets were used as spotters for strike missions conducted by other F-16s known as "Killer Bees."

Crew:	1	Engine:	one F100-PW-200
Max Speed:	770	Gun:	1x M61A1 20mm gun
Sensors:	RWR, APG-68		
Ord:	GBU-15, AIM-9L, AMRAAM, ECM pods, 500 lb. bmbs,		

F/A-18 Hornet

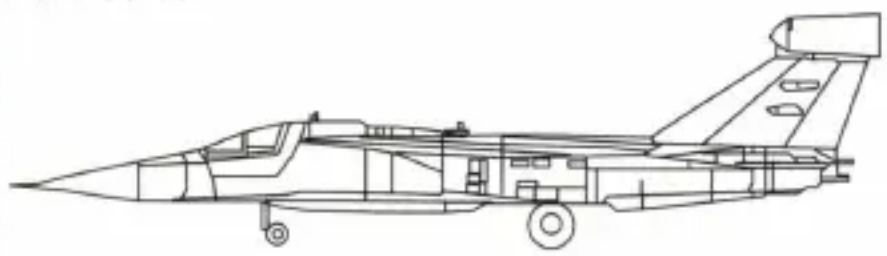


F/A-18 HORNET

The Hornet is a multi-role aircraft combining excellent fighter and strike characteristics. Although not as maneuverable as the F-16, the F/A-18 is capable of delivering a variety of air to ground ordnance. These aircraft replace F-14s on aircraft carriers featuring heavy strike wings.

Crew:	1(A)	Engine:	two GE F404 turbofans
Max Speed:	752	Gun:	1x 20mm Vulcan gun
Sensors:	RWR, FLIR, Laser designator, APG-65 radar,		
Ord:	AIM-7, Harpoon, Maverick, Rocket Pods, bmbs, ECM pod		

F-111 Aardvark

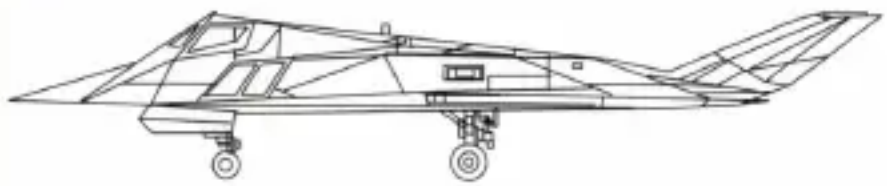


F-111 AARDVARK

The selection of the F-111 in 1962 to replace the F-105 caused somewhat of a Washington scandal. Defense Secretary McNamarra was accused of "buying the second best aircraft at the higher price." However, the F-111 became the first aircraft able to penetrate enemy airspace using terrain following radar. During the Gulf War, it was used as an Electronic-Warfare aircraft and nicknamed "Spark Vark."

Crew:	2	Engine:	two P&W TF30-100 turbofans
Max Speed:	810	Gun:	1x 20mm Vulcan gun
Avionics:	AVQ-26 Pave Tack, FLIR, APQ-144 Radar, APQ-110 TF		
Ord:	GBU-15, AIM-9L, ALQ-131, 500lb bmbs		

F-117 NightHawk Stealth Fighter

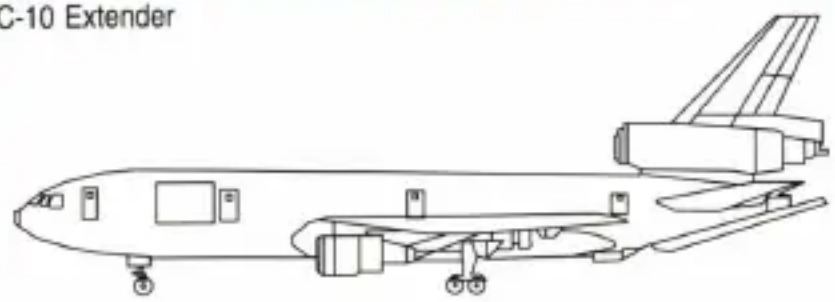


F-117 NIGHTHAWK STEALTH FIGHTER

The F-117A, nicknamed the "Wobbly Goblin" because of its inherently unstable design, became the overnight star of the Persian Gulf War. Its stealth characteristics allowed it to attack heavily defended Iraqi targets without sustaining any battle damage. Speed and payload are somewhat limited however.

Crew:	1	Engine:	two GE F404-F1D2 turbofans
Max Speed:	568	Gun:	None
Sensors:	RWR, FLIR, laser designator, DLIR		
Ord:	HARM, Maverick, bmbs		

KC-10 Extender



KC-10 EXTENDER

The McDonnell Douglas Extender is a long range airborne refueling platform based on the DC-10. A single KC-10 is able to deliver over 200,000 lbs. of fuel and can itself be refueled if necessary. Stationed at Seymour-Johnson alongside the F-15Es are the 344th and 911th Air Refueling Squadrons.

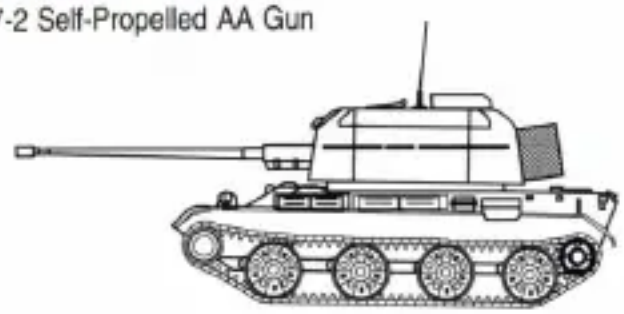
Crew:	5	Engine:	three GE CF6-50C2 turbofans
Max Speed:	553	Gun:	None
Sensors:	commercial avionics		
Ord:	None		

Jane's Defense Group

The KC-10 Extender enables players to perform missions against targets that the F-15E normally could not reach. In F-15 Strike Eagle III, a KC-10 is stationed at 25,000 feet well out of harm's way. Missions that require a mid-air refueling, both begin and end at the tanker.

SELF-PROPELLED ANTI-AIRCRAFT ARTILLERY

ZSU-57-2 Self-Propelled AA Gun

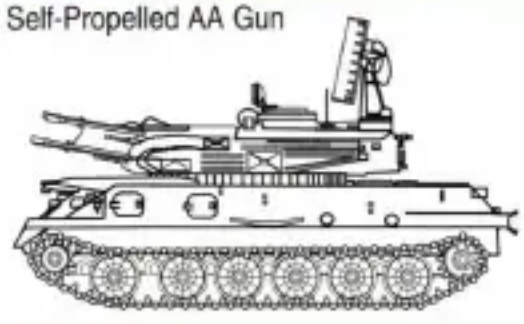


ZSU-57-2 SELF-PROPELLED AA GUN

The Soviet built Zenitnaia Samokhodnaia Ustanovka (ZSU-57-2) was first seen publicly during a Moscow parade in 1957. These vehicles are based on a lightly armored T-54/55 chassis and mount twin 57mm S-68 guns. Each of the guns is fully automatic, recoil operated and have a sustained rate of fire of over 70 rds. per minute. The ZSU 57-2 lacks an all-weather capability and NBC protection for its crew.

Crew:	6	ROF:	140 rpm
Armor:	Light	Veh Spd:	32 mph

ZSU-23-4 "Shilka" Self-Propelled AA Gun

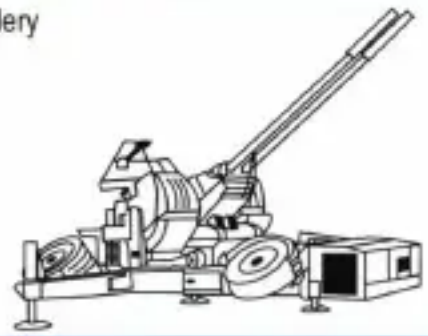


ZSU-23-4 "SHILKA" SELF-PROPELLED AA GUN

The ZSU-23-4 or Shilka (Owl) is an extremely effective triple-A weapon. Its quad 23mm guns are controlled by a microwave target acquisition system and are effective out to a range of 6,000 feet. The Shilka is designed to provide first line maneuver units with mobile air defense. There are usually 16 ZSU-23-4s per Soviet division. First used outside the Soviet Union in 1973 by Arab client states during the Yom Kippur war. Fire control is provided by a J-band Gun Dish radar and can track targets at ranges exceeding 8 nm.

Crew:	4	ROF:	4000 rpm
Armor:	Light	Veh Spd:	29 mph

Anti-Aircraft Artillery



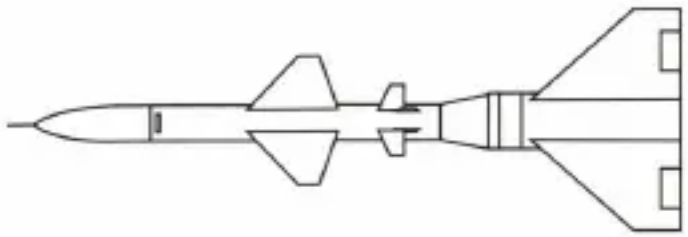
ANTI-AIRCRAFT ARTILLERY:

Anti-Aircraft Artillery, or Triple-A as it has become known in the post-Gulf war lexicon, is treated generically in this simulation. The ground fire that you see over major cities and installations represents groupings of AAA batteries, some of which are radar-controlled. Triple-A usually is not directed at a specific target, however. It is too difficult to target aircraft travelling very fast at low altitudes. Rather, gunners try to put up a wall of lead hoping that you'll fly into it. It is not very effective but then again it doesn't have to be. Anti-aircraft shells are cheap compared to a multi-million dollar F-15.

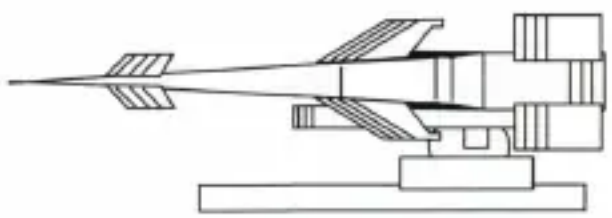
SURFACE TO AIR MISSILES

Roland-1 SAM

SA-2 Modified "Guideline" Fixed-Site SAM



SA-3 "Goa" Fixed-Site SAM



"SAMS"

ROLAND-1 SAM

Iraq was in possession of over 100 Roland-1 static SAM systems at the beginning of the Gulf War although it has not been determined if they were operational. The Roland-1 is distinguished from the Roland-2 by its lack of an all-weather capability. The Iraqi Rolands use a French made Tiger (TRS-2100) radar for target acquisition. The Roland is designed to engage fast moving targets at low altitude. It may be operated in both optic and radar guided modes which can be interchanged while the missile is in flight. The missile is a solid fuel, two stage SAM with an warhead consisting of 3.5 kg. of high explosive.

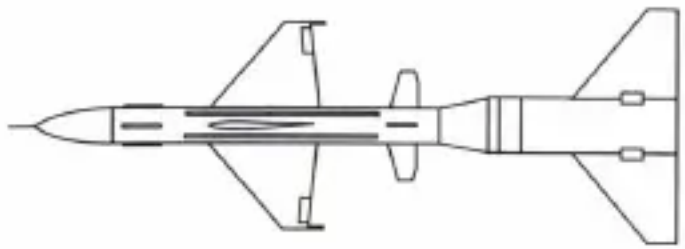
SA-2 MODIFIED "GUIDELINE" FIXED-SITE SAM

The SA-2 was nicknamed the "flying telephone pole" by U.S. flight crews during the Vietnam war. The missile is a beam-rider, command guided by an E-band Fan Song radar. The SA-2 has a slant range of 20-30 nm and can engage targets up to 18,000 feet. The Guideline has terrible acquisition problems at low altitudes and lacks the ability to make drastic course corrections. The warhead is command detonated by computer once the missile comes within proximity of the target. The first U.S aircraft loss of the war was an F/A-18 downed by an SA-2 over western Iraq. Iraqi SA-2s have been modified to increase their range and accuracy.

SA-3 "GOA" FIXED-SITE SAM

The Goa is a two-stage SAM designed for use against low flying aircraft at short ranges. The SA-3 uses an I/J band radar for fire control and an acquisition radar known by the NATO code name Flat Face. It has a range of 13.7 nm and an operational ceiling of 13,000 feet. Targeting data is provided by a Low Blow radar system able to guide two missiles simultaneously. The Low Blow radar has been retrofitted with a back-up TV camera for command guidance when jammed.

SA-5 Gammon Fixed-Site SAM



SA-5 GAMMON FIXED-SITE SAM

The SA-5 has been operational since 1967. It is designed as a long range point defense system to be used against medium to high altitude targets. Although the Gammon has a maximum range of 140 nm, it cannot engage targets at less than 60 kilometers. Mid-course corrections are provided by a Square Pair radar. The SA-5 is equipped with a active radar homing seeker for terminal guidance. North Korean SA-5s stationed near the DMZ have a range which threatens a significant portion of South Korea's air space.

SA-6 Gainful Self-Propelled SAM

SA-6 GAINFUL SELF-PROPELLED SAM

The SA-6 is a self-propelled system designed to engage targets at low to medium altitude. Each system consists of three SA-6 missiles mounted on an ASU-85 chassis data linked to a Straight Flush radar. The Straight Flush radar is equipped with a back-up optical TV camera with a range of 16.4 nm in case of jamming. Initial target acquisition is made at long range by Long Track E- band surveillance radar. Final guidance to target is provided by a semi-active homing seeker.

SA-7 Grail Man-Portable SAM

SA-7 GRAIL MAN-PORTABLE SAM

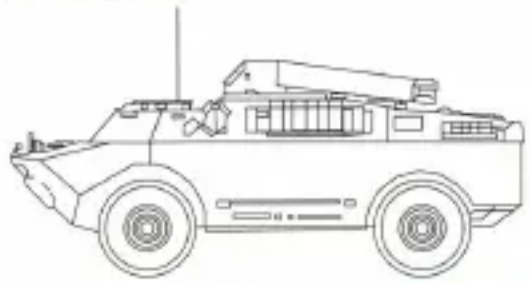
The Grail is a shoulder fired SAM designed to engage fast moving, low altitude targets at short ranges. It uses an IR seeker which must be fired from within 30 degrees of the target's tail aspect. The missile is easily decoyed by alternate heat sources. Rotating counterclockwise for stability, the SA-7 can attain a maximum speed of Mach 1.2. With only a 1.1 kg. HE warhead, multiple hits are usually required to knock down a target. The main effect of the SA-7 seems to be in forcing aircraft to fly at higher altitudes where they can be engaged by other SAM systems.

SA-8 Gecko Self-Propelled SAM

SA-8 GECKO SELF-PROPELLED SAM

The SA-8 is an all-weather missile designed for use against low flying targets. It is a self-propelled SAM system which uses a 6x6 BAZ-5937 vehicle for transport. The Gecko is a single stage missile which can reach a maximum speed of Mach 2.4 and is able to engage targets at ranges exceeding 8 nm. The missile uses a fire control H-band Land Role radar, for target tracking a J-band mono-pulse radar is utilized. There are also two additional monopulse radars which may assist in tracking targets in an active ECM environment.

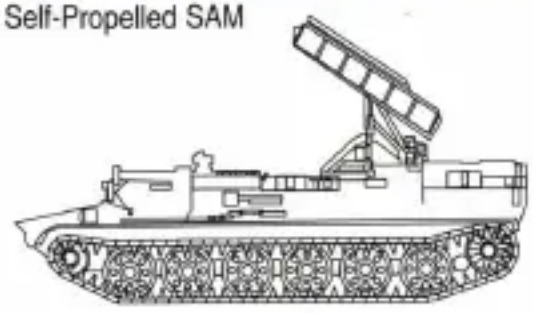
SA-9 Gaskin Self-Propelled SAM



SA-9 GASKIN SELF-PROPELLED SAM

The SA-9 was developed in tandem with the ZSU-23-4 to provide forward area low altitude air defense for mobile formations. This self-propelled SAM system consists of a BRDM launcher with four ready missiles. The Gaskin is a heat seeking missile with a maximum range of 3.5 nm. It contains a 2.6 kg. warhead filled with high explosive and a proximity fuze. The operator acquires targets through optical sights and then slews the weapon mount to the desired azimuth. The missile is launched once the operator receives an audible tone signaling the target is acquired.

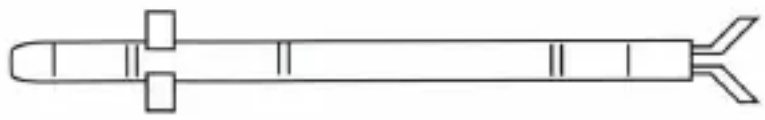
SA-13 Gopher Self-Propelled SAM



SA-13 GOPHER SELF-PROPELLED SAM

The SA-13 is a heat seeking SAM system mounted on an amphibious MT-LB chassis. The vehicle provides NBC protection for the three man crew. Each vehicle contains four Gopher missiles housed in enclosed rectangular launchers along with eight additional stored reloads. Introduced in 1980, the Gopher is currently replacing the SA-9 Gaskin in front line Soviet units. A simple range-only "Dog Ear" radar gives the SA-13 the ability to acquire targets out to a range of 45 nm. The missile has a 6 kg. HE fragmentation warhead equipped with a proximity fuze.

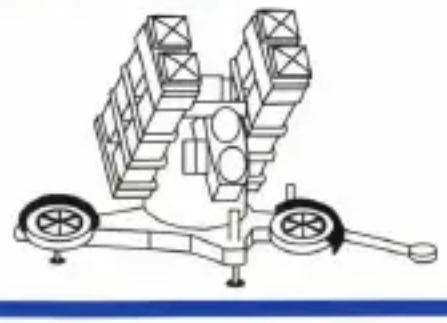
SA-14 Gremlin Man-Portable SAM



SA-14 GREMLIN MAN-PORTABLE SAM

The SA-14 is an improved version of the earlier SA-7 Grail. The Gremlin features a more powerful 2 kg. HE fragmentation warhead and greater engagement ranges. The SA-14 is said to possess an advanced IR detection ability which is less easily fooled by common IR decoy measures. The missile is able to track targets through maneuvers up to 8 g's. The engagement range for head-on targets is 4 kilometers. Fired from a tail-chase aspect, the Gremlin can engage targets at ranges up to 3.3 nm. The SA-14 is found with front line units replacing the older stocks of SA-7s.

Skyguard/Sparrow Gun Missile System



SKYGUARD/SPARROW GUN MISSILE SYSTEM

The Skyguard features a dual air defense system consisting of two twin Oerlikon GDF 35mm guns and two active missiles launchers containing four AIM-7 Sparrows. The weapons systems are managed by a Skyguard Fire Control System featuring two pulse-doppler radars (Track and Search) and a back-up TV tracking camera. The Skyguard computer has "track while scan" capability for engaging multiple targets. The 35mm guns are used to engage fast moving low flying aircraft at ranges of up to 2.5 nm. The AIM-7s are unmodified Sparrow missiles normally mounted on interceptor aircraft.

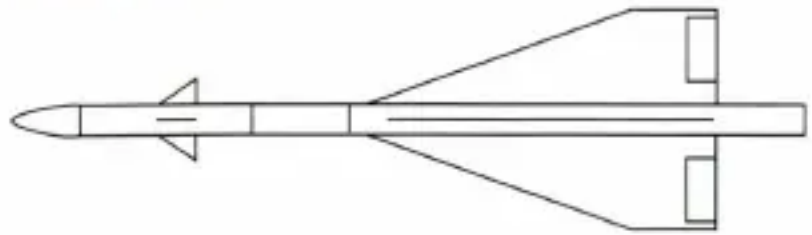
THREAT AIR TO AIR MISSILES

AA-2 Atoll

AA-2 ATOLL

The AA-2 Atoll was originally designed and produced during the 1960s. It was a reproduction of the early AIM-9B Sidewinder heat-seeking missile. Since the missile has been periodically upgraded. There are now two versions of this missile; the improved heat-seeking AA-2D and radar-guided AA-2C. Despite the improvements, the AA-2D may only track targets from a tail-chase aspect only. The AA-2D uses a solid propellent and has a maximum range of 1.6 nm. The AA-2C incorporates a semi-active radar homer and has a maximum range of 4.5 nm.

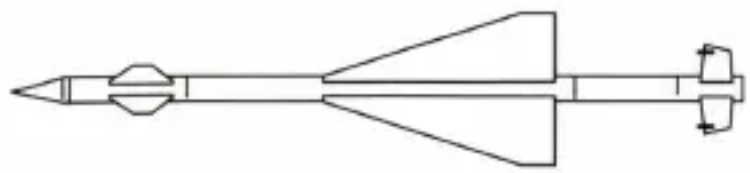
AA-6 Acrid



AA-6 ACRID

The AA-6 Acrid is a Soviet-made missile which entered service in the early 1970s. It was specifically designed for use aboard the MiG-25 Foxbat which generally carries two AA-6 on its outboard hardpoints. As one of the largest air-to-air missiles in the world, the Acrid uses a solid propellant and has a maximum range of almost 20 nm. Production of these missiles stopped in 1982 but many have been exported since that time. It is assumed that the Acrid uses a semi-active radar guidance, however, improved models may contain an active radar seeker for use during terminal flight.

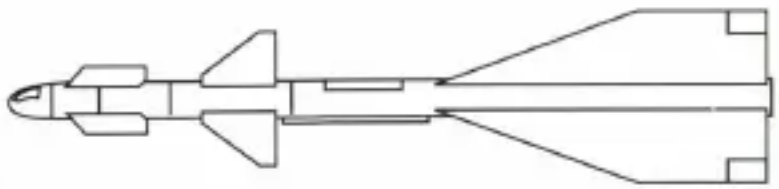
AA-7 Apex



AA-7 APEX

The AA-7 Apex was first detected by Western sources in the mid-1970s. It is a third generation Soviet medium range, radar-guided missile. The Apex is superior in performance to the U.S. AIM-7 Sparrow and boasts a "look-down-shoot down" capability. The missile is equipped with a semi-active J-band radar seeker which is effective against low flying targets. The warhead represents approximately 15% of the missile's overall weight and is fitted with an active radar fuze. The Apex is carried by MiG-23s, MiG-25s, and the latest MiG-29 Fulcrum fighters.

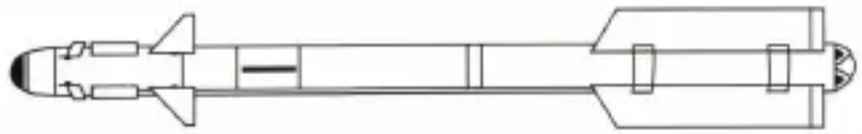
AA-8 Aphid



AA-8 APHID

The AA-8 Aphid was designed as a replacement for the aging Soviet inventory of Atoll missiles. Carried in pairs by most Soviet fighters, the Aphid is a heat-seeking missile with a maximum range between 1.6 and 3 nm. Although radar-guided versions of this missile have been reported, to date only the IR model has been seen on Soviet fighters. Early Aphid models had only a tail-chase engagement aspect but later reproductions have been fitted with an electro-optical fuze. This addition gives the missile a much broader tracking envelope.

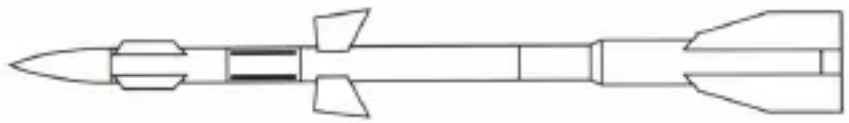
AA-10 Alamo



AA-10 ALAMO

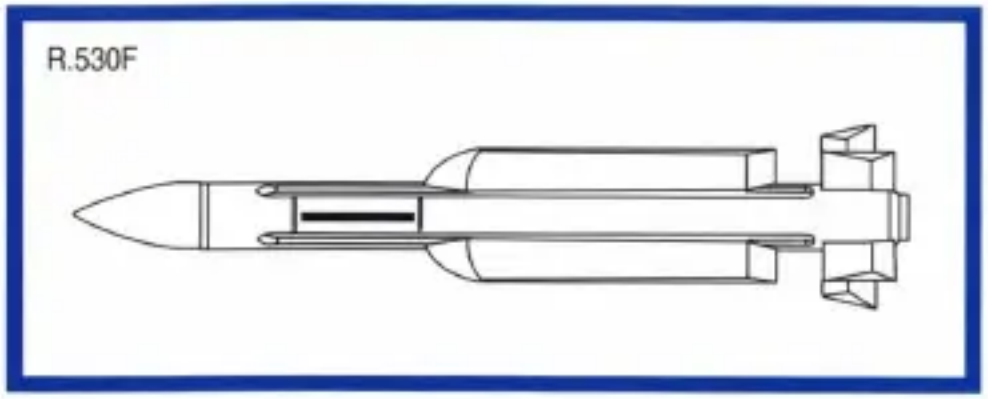
There are a number of related Alamo missile types; the semi-active radar-guided AA-10A,the heat-seeking AA-10B, and a longer range radar-guided version known as AA-10 Alamo C. The Alamo B version has a range of 14 nm which is long by Infrared standards. It features an improved IR head which is less susceptible to counter-measures. The A and C models have ranges of 14 and 20 nm respectively. Both have semi-active J-band monopulse radars. An active seeker is currently under development and can be expected to enter service shortly.

AA-11 Archer



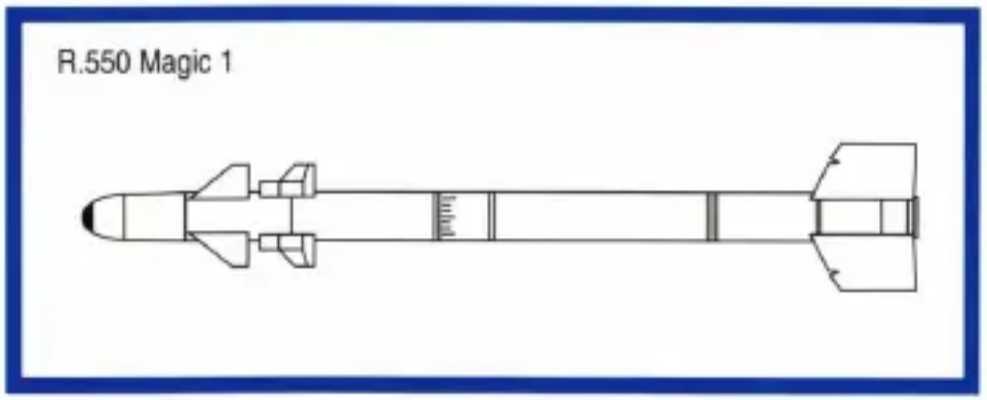
AA-11 ARCHER

The AA-11 Archer is a fourth generation Infrared (heat-seeking) missile. It entered service with the Soviet Air Force in the late 1980s. Since that time it has been selectively exported to a small number of client states. The Archer is carried by only the most advanced Soviet fighters. In the MiG-29, the missiles are slaved to the pilot's helmet-mounted designator. This allows the pilot to engage targets at a high off-angle. The Archer has a short range, all-aspect engagement envelope and is able to track fast-moving, highly-maneuverable targets. It carries a large warhead equipped with an active radar fuze. The maximum range for this missile is believed to be around 4.5 nm.



R.530F

The R.530F is manufactured in France by the Matra firm. It may be carried on most Mirage series aircraft. The R.530F is a medium ranged, radar- guided missile which carries a 30 kg. fragmentation warhead. Early models of this missile suffered from being easily decoyed by ECM. With a range of only 14 nm, the R.530F has been rendered obsolete by more recent improvements to the design. Many of these missiles remain in service with Third World air forces, especially those equipped with Mirage fighters.

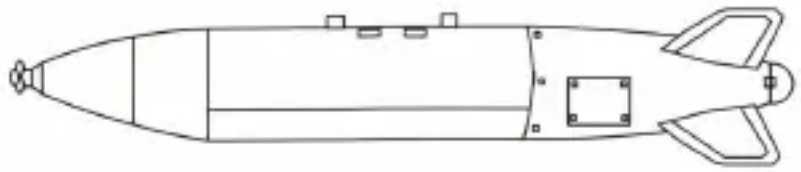


R.550 MAGIC 1

The R.550 Magic 1 is a French-built, short-range IR missile. It entered service in the mid-1970s. France exported a number of these missiles in sweet-heart deals to countries which also purchased French aircraft and over 7,000 of these missiles are in the hands of foreign customers. Although the Magic 1 lacks the all-aspect capability of the later Magic 2, the R.550 is a rough equivalent to the early model Sidewinders. In fact, the missile was designed with to be compatible with any aircraft capable of using Sidewinders. The Magic 1 has a range of almost 3 nm and carries a 13 kg. HE fragmentation warhead.

AIR TO GROUND ORDNANCE

MK 82 500lb General Purpose Bomb



MK. 82 500LB GENERAL PURPOSE BOMB

The Mark 82 500lb GP bomb was originally designed in the 1950s. It functions as a general purpose unguided munition suitable for internal and external mounting. The weapon can be configured with a number of different fuze mechanisms. The Mk. 82 casing has also been used as an underwater mine on occasion. When the Mk. 82 is fitted with a BSU-49 (BALLUTE) balloon retard system it is then re-designated the Mk. 82 RE GP bomb.

Best Used Against: exposed infantry, unarmored vehicles, installations

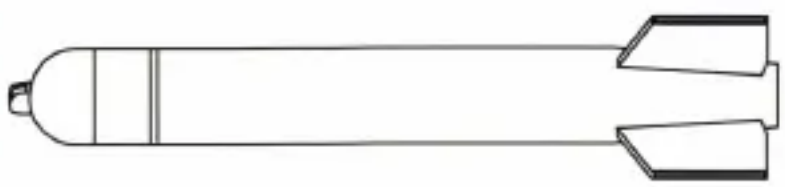
MK 84 2000 lb. General Purpose Bomb

MK. 84 2000 LB. GENERAL PURPOSE BOMB

Remarks for the Mark 84 2000 lbs. GP bomb echo comments for the Mk. 82 GP bomb. The difference is in the greater weight and explosive power of the Mk. 84. The Mk. 84 is designed for low drag on external hardpoints but the added weight limits the number that may be carried. As with the Mk. 82, a number of fuze mechanisms and explosive types may be used. For example, when the Mk. 84 is fitted with a BSU-50 (BALLUTE) balloon retard system it is then re-designated the Mk. 84 RE GP bomb.

Best Used Against: exposed infantry, unarmored vehicles, installations

MK 20 Rockeye II Cluster Bomblets

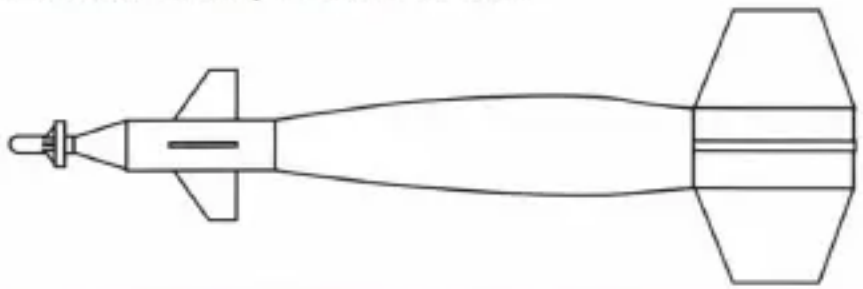


MK 20 ROCKEYE II CLUSTER BOMBLETS

The Mk 20 Rockeye II is a free-fall cluster bomb with internally stored sub-munitions. Delivered from the same attack profile as an ordinary 500lb bomb, the Rockeye dispenser releases approximately 850 armor-piercing bomblets over a wide target area. The Rockeye Mk. 339 dispenser has a delayed opening feature which allows aircraft to make its run up on a target from very low altitude. In fact, Rockeye munitions may be released from altitudes under 100 feet if the aircraft's nose attitude is pitched up. By altering the aircraft's speed and release altitude, the impact area may also be enlarged or decreased.

Best Used Against: tanks, vehicles, depots, parked aircraft, radar sites

GBU-10E/B "Paveway II" 2000 lb. GP Bomb



GBU-10E/B "PAVEWAY II" 2000 LB. GP BOMB

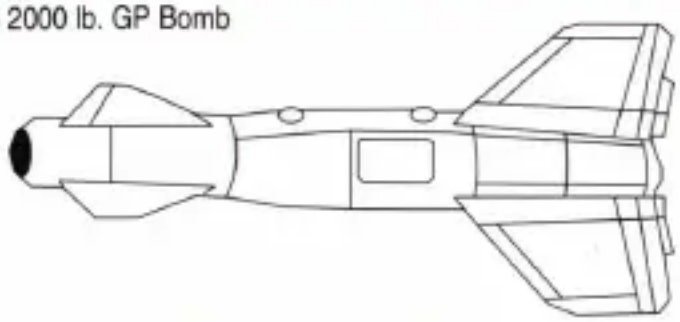
The GBU-10 is a 2000 lb. General Purpose bomb retro-fitted with a Paveway laser-guidance unit. The Paveway system instantly transforms a common "iron" bomb into a laser-guided smart bomb. The guidance system uses laser energy reflected off the target to direct the weapon. Control surfaces on the bomb react to guide the bomb towards the designated aiming point. The target may be laser designated by the delivering aircraft, other aircraft in the package or even from the ground. This method of delivering ordnance minimizes the time spent exposed to ground fire.
Best Used Against: troop concentrations, soft targets, installations

GBU-12D/B "Paveway II" 500lb GP Bomb

GBU-12D/B "PAVEWAY II" 500LB GP BOMB

The GBU-12 is a 500lb General Purpose bomb which, like the GBU-10, glides to the target while being guided by reflected laser energy. The Paveway laser-guided bomb (LGB) program is under development by Texas Instruments. In the Gulf war, Special Forces teams deep inside Iraq designated SCUD missile sites using hand held laser devices. F-15s equipped with these "smart" bombs were then called in to strike with pin point accuracy.
Best Used Against: troop concentrations, soft targets, installations

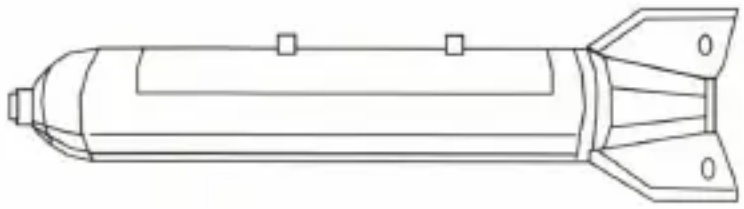
GBU-15 2000 lb. GP Bomb



GBU-15 2000 LB. GP BOMB

The GBU-15 is simply a Mk. 84 GP bomb which has been converted to a "smart bomb." The difference is the guidance system which is attached to the Mk. 84 casing and uses either TV optics or thermal Infrared. The system allows the delivering aircraft to launch without first achieving a target "lock." `The GBU-15 requires a AXQ-14 data link pod to operate and may be delivered in guidance being provided by a companion aircraft. Video images are continuously transmitted from the weapon while in flight. A powered version of this bomb, the AGM-130, is currently under development.
Best Used Against: exposed infantry, unarmored vehicles, installations

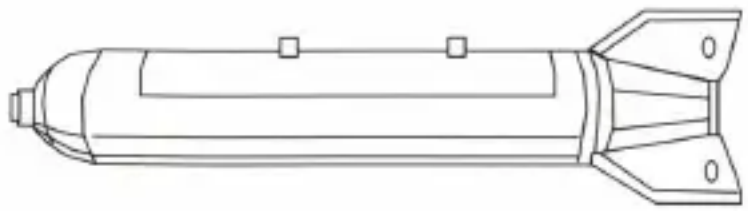
CBU-87B Combined Effects Munition



CBU-87B COMBINED EFFECTS MUNITION

The CBU-87B is a freefall cluster bomb containing 202 armor piercing sub-munitions. Each of the bomblets contains a shaped charge which detonates after penetration. Alternatively, the bomblets may be delivered on exposed troops by using a fragmented casing. While in flight a pilot (or "Wizzo") can select either of two fuze options; timed or proximity. The munition can be released from altitudes as low as 200 ft.
Best Used Against: exposed infantry, armored vehicles, structures

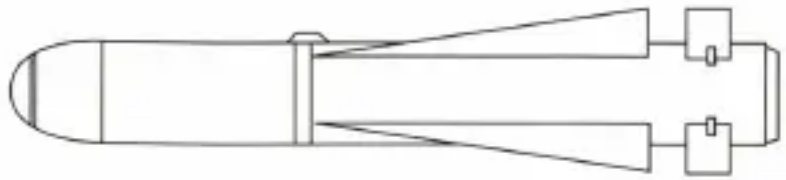
CBU-89 Gator



CBU-89 GATOR

The CBU-89 is a freefall cluster bomb which contains a mix of anti-armor and anti-personnel mines. When the cluster munition is released, 94 Gator mines are scattered over a wide area. This weapon is particularly effective when used in conjunction with other types of ordnance. For example, these mines could be dropped on an airfield to hamper repair crews after a Durandal strike. The CBU-89 can be used anywhere the need for an instant barrier arises. Advancing armor could be immediately halted by dropping Gator mines in front of their line of march.
Best Used Against: troop concentrations, armored vehicles, airfields

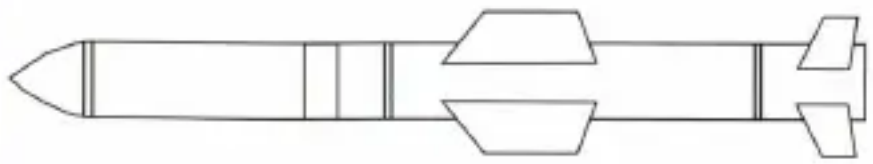
AGM-65D Maverick



AGM-65D MAVERICK

The AGM-65 Maverick is a highly accurate air to ground missile which can use a variety of guidance options. The AGM-65A model uses a simple TV system which allows the operator to "lock-on" to the target. The AGM-65D uses an Imaging Infrared (IIR) which gives the weapon a night capability. Maverick missiles are "fire and forget" weapons once the weapon has "locked-on" to a target. The thermal imaging is of such resolution that A-10 pilots Warthogs used the IIR as a poor man's FLIR. Later model Maverick missiles have an effective range approaching 13.7 nm.
Best Used Against: armored vehicles, hardened bunkers, ships

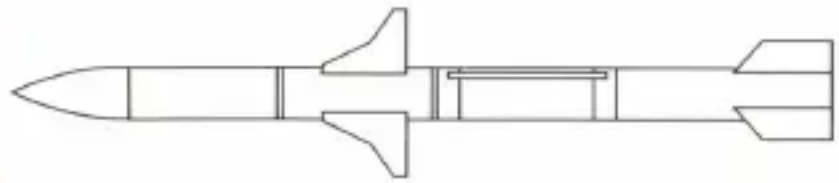
AGM-84 Harpoon



AGM-84 HARPOON

The AGM-84A Harpoon is an air launched, medium range, anti-ship missile with a maximum range approaching 65 nm. It is designed as a sea-skimmer, flying very low over water using inertial guidance. Once in terminal mode the missile activates a phased-array J-band radar seeker to acquire its target. The missile is usually fired after the range and bearing of a target is known. However, the Harpoon may be launched using a technique known as Bearing Only Launch (BOL). In this case the missile is simply launched along a particular bearing with its radar seeker looking for any target within a 45 degree search arc. The 220 kg. warhead is more than enough to cripple or sink medium sized warships with a single hit.
Best Used Against: naval vessels

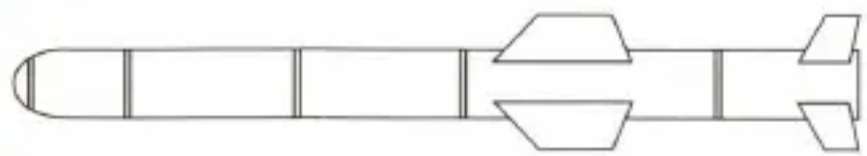
AGM-84E SLAM



AGM-84E SLAM

The AGM-84E Stand-off Land Attack Missile (SLAM) is a cross-bred weapon system. It combines a Harpoon fuselage with the Imaging Infrared (IIR) seeker commonly used on AGM-65D Mavericks. The SLAM has a maximum range of approximately 60 nm, less than its predecessor. This reflects the weight of additional targeting equipment. Once the missile reaches its terminal phase the IR seeker "locks-in" a video image. At that point the missile will proceed to the target without further guidance from the launching aircraft. The missile uses the Global Positioning System (GPS) to provide mid-course corrections for its inertial guidance.
Best Used Against: fixed installations, wide range of soft targets

AGM-88M HARM



AGM-88M HARM

The AGM-88 HARM, or High-speed Anti-Radiation Missile, is currently replacing the Shrike and Standard ARM. It entered service in 1983 and was first used in combat during the 1986 strike on Libya. HARMs are used exclusively to suppress or destroy enemy radar installations. The AGM-88A can be programmed to attack pre-selected targets or launched on a set bearing to engage targets of opportunity. Used extensively during the Gulf war, over 1,000 were fired mainly by F-4G Wild Weasels. The HARM causes hostile radars to cease emitting radiation or risk a direct hit. The AGM-88A carries a 66 kg. fragmentation warhead and has a range of over 12 nm.
Best Used Against: radar emitters

BLU-107/B Durandal

BLU-107/B DURANDAL

The Durandal is a French made anti-runway weapon containing 15 kgs. of high explosive. Durandal missions are often the most hazardous because they require pilots to fly straight and level over a runway. The bomb must be dropped from at least 75 meters to allow time for the tail-mounted parachute to deploy. The bomb deploys a parachute to slow its descent. When the weapon is perpendicular to the ground a solid fuel rocket ignites with sufficient force to drive the weapon through a concrete surface. The Durandal has a delayed fuze which detonates the weapon underneath the surface in order to maximize the cratering effect. The explosion often has an eerie mushroom-cloud signature.
Best Used Against: Paved Surfaces, Runways

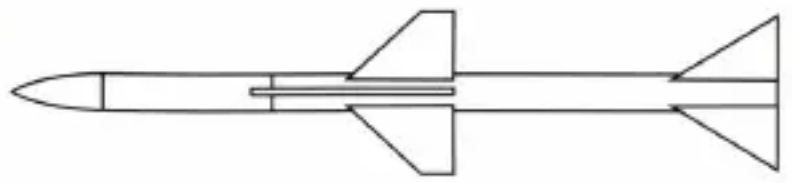
AIR TO AIR WEAPONS

AIM-9M Sidewinder

AIM-9M SIDEWINDER

The Sidewinder is a widely used medium range, heat seeking (IR) missile. Early models suffered from an inability to engage targets near the ground. Subsequent modifications have eliminated this problem plus given the missile an all aspect capability. The F-15 was first issued Sidewinders in 1977 (AIM-9J). Current models feature a reduced smoke propellant to make aerial detection difficult. Maximum engagement range is roughly 5 nm but depends entirely on the shooter's aspect angle.

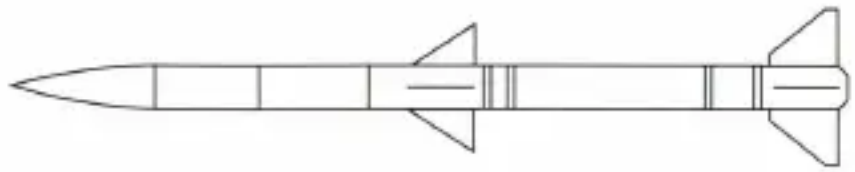
AIM-7M Sparrow



AIM-7M SPARROW

The AIM-7 Sparrow is a radar guided air to air missile with a range of 17 nm. The firing aircraft must obtain a radar "lock" on the target prior to firing. Once a target is "locked," the shooter must keep the target within his radar envelope or the missile will "go ballistic." The missile features an on-board processor which can be programmable to combat the effects of target ECM. The USAF and USN are expected to acquire an inventory of 17,000 Sparrows until the AMRAAM comes into full production. During the Gulf war, Sparrow "kills" outnumbered those made by Sidewinders by a ratio of 4-1.

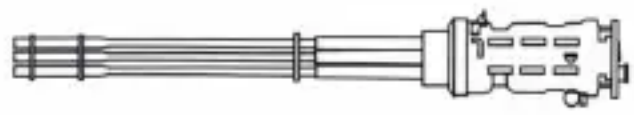
AIM-120A AMRAAM



AIM-120A AMRAAM

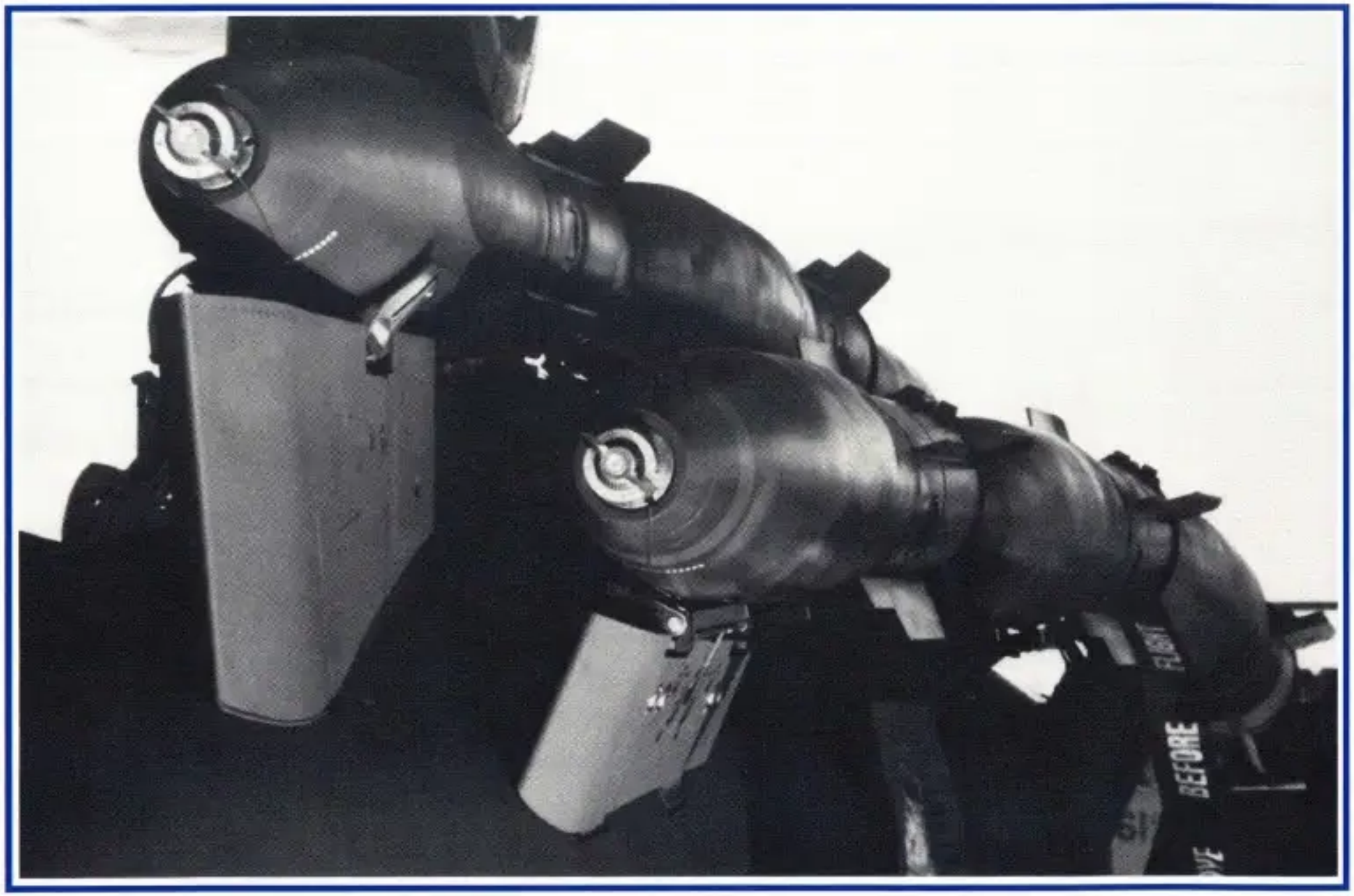
The AIM-120A Advanced Medium-Range Air to Air Missile (AMRAAM) began development in 1975. It is designed to replace the Sparrow on F-15s in 1990s. The missile features a low smoke propellent and is expected to have a maximum head-on target aspect range of 28 nm. The AMRAAM warhead weighs approximately 22 kg. and contains an active radar proximity fuze. Production began in the late 1980s at around 180 missiles per year. The AIM-120A is a "fire and forget" missile. Once launched it needs no further guidance from the firing aircraft. The missile has an active homing radar in its nosecone.

M61A1 20mm Vulcan Gun



M61A1 20MM VULCAN GUN

The F-15E is equipped with a six barrelled Gatling-type gun made by General Electric. The 20mm Vulcan has a sustained rate of fire approaching 6,000 rounds per minute. Normally, the F-15E carries just over 500 rounds of 20mm (0.8 inch) ammunition. The Vulcan is able to accelerate to its maximum rate of fire in less than half a second and features a linkless feed system which is powered externally. The Vulcan is essentially 1950's technology but has proven to be extremely reliable. The average life of a single barrel is approximately 20,000 rounds. With an effective range of only 3,300 ft, the gun is a weapon of last resort after the medium and short range missiles have failed.



Hans Halberstadt/Arms Communication

6. APPENDICES

I. GLOSSARY

A

AAA: anti-aircraft artillery (more commonly known as "Triple A")
AAR: Air-to-Air Refueling
ABC³: (Airborne Command, Contol and Communications) an EC-130 which directs air battles from a distance
ACM: Air combat maneuvering (dogfighting)
ADA: air defense artillery
AGL: Above Ground Level (referring to altitude)
AMRAAM: Advanced Medium Range Air-to-Air Missile
angels: refers to altitude measured in 1,000s of feet; angels 35 is equivalent to 35,000 feet
angle of attack (AOA): the angle between the aircraft's mean chord line and the relative wind
ARM: Anti-radiation missile
ASL: Above Sea Level (refers to altitude)
ASM: Air to Surface missile
aspect angle: angle between defender's flight path and attacker's flight path measured from defender's six o'clock, usage: AIM-9L is an all-aspect missile.
ATO: Air Tasking Order
AWACS: Airborne Warning and Control System
azimuth: angular measure or direction in the horizontal plane

B

bandit: identified enemy aircraft
BDA: Bomb damage assessment (or alternatively Battle Damage Assessment)
bearing: the horizontal direction to or from any point, usually measured clockwise in degrees
belly check: a 90° roll which enables the pilot to look below his aircraft for possible bandits
BFM: Basic Fighter Maneuvers
"Bingo Fuel": radio call that aircraft only has enough fuel remaining to return to base
"blind": No Tally on Bandit, no visual on Good Guys, pilot sees nothing
"blow thru": high speed closure with enemy formation indicating no intention of turning to engage
blue on blue loss: shooting down a friendly aircraft
bogey: a radar/ visual contact of unknown identity
"break": radio call indicating an immediate high-g turn
burner: afterburner
BVR: Beyond Visual Range

C

CAP: Combat Air Patrol - standard fighter mission; go out and shoot down enemy aircraft within a certain patrol area.
CAS: Close Air Support

C³I: Command, Control, Communications and Intelligence (pronounced Cee-Three-Eye)
CBU: Cluster Bomb Unit
cell: Two or more tankers/bombers flying in formation
chaff: active form of electronic countermeasure, usually carried in a pod or dispenser aboard an aircraft and released to disrupt radar tracking and/or acquisition
Check "six": look behind you (always)
"Chicks": Friendly aircraft
chord line: a straight line drawn through the cross section of an airfoil (wing) from the leading edge to the trailing edge
closure: relative rate of approaching aircraft
combat spread formation: aircraft flying line abreast (off each other's wings)
conformal: shaped surface which "conforms" to aircraft's exterior
contact: Full radar information on target

D

dash: flight profile maximizing speed, usually a very high altitude straight line flight
debriefing fluid: drinks at the local club after a mission
dolly: Data link equipment
drag: any impediment to forward movement through the air
DPRK: Democratic People's Republic of Korea (North)
"DWE": (pronounced Dweee), pilot slang for "Damn Wizzo Ejected"

E

"Eagle Keepers": ground crew members charged with taking care of F- 15s
"Eagle Meat": F-5s used to outfit "aggressor" squadrons at Nellis AFB
ECM: electronic counter-measure
egress: route of exit from the target area
EW: Electronic Warfare

F

FAC: Forward Air Controller
FAST pack: Fuel and Sensor (Tactical) conformal station
FEBA: Forward Edge of the Battle Area (i.e. the front line)
"Feet Dry": flying over land
"Feet Wet": flying over water
"Fence In": slang for entering enemy controlled airspace, a mission phase line not necessarily a political boundary
"Fence Out": leaving enemy territory, opposite of Fence In
"Fight's On, Fight's On": call to initiate combat, opposite of "Knock it Off"
flight envelope: performance limits of a particular aircraft
flight level: reference to altitude starting with 19,000 feet, i.e. flight level 350 equals 35,000 feet, flight level 260 equals 26,000 feet.
FLOT: Forward Line of Own Troops (something aircraft have always had trouble discerning)
"flying telephone poles": Vietnam era slang for SA-2 SAMs
"flush": precautionary scramble to avoid being caught on the ground
F-Pole: distance from launching aircraft to the missile at target impact
Fox I: launch of Sparrow radar-guided missile
Fox II: launch of a Sidewinder heat-seeking missile
Fox III: launch of AMRAAM radar-guided missile
"FURBALL": multiple aircraft engagement (a dogfight)

G

g-force: measurement of gravity force; two g's would be twice normal gravity
GBU: Glide Bomb Unit
GCI: Ground Control Intercept radar installation
gimble limit: physical stop in the traverse of a mechanism, limiting its field of motion
"Gomer": slang for opposing fighter pilots
"Graveyard Spin": uncontrollable spiral into the ground

H

"Hawk": staying above a dogfight without engaging
HAWK: (Homing All the Way Killer) SAM
hits: sporadic radar returns without getting full information
Homeplate: your Home airfield or base
HOTAS: Hands On Throttle And Stick
HUDWAS: HUD weapon aiming sight

I

ILS: Instrument Landing System
ingress: approach route toward target
IR: InfraRed
IIR: Imaging InfraRed

J

J-band: EM radiation 10-20 GHz
jinking: erratic defensive maneuver designed make a firing solution difficult
"Joker": fuel limit indicating when it's time to begin disengaging from a fight, limit is set just a bit higher than BINGO fuel

K

KIAS: Knots- indicated air speed
"Knock It Off": terminate fighting maneuvers immediately, normally used only in training
knot: one nautical mile per hour, equal to 1.15 statute miles

L

lawn dart: refers to the F-16 because of the high accident rate
Load factor: sum of forces, both static and centrifugal, acting on an aircraft's structure measured in g's (units of gravity.)
LRMTS: Laser ranger and Marked Target Seeker
Lufberry: a circular track flown by opponents who cannot close with one another to achieve a firing solution

M

MAPLE FLAG: USAF training exercises held at Cold Lake CFB, Alberta Canada, equivalent to RED FLAG but staged over European-like terrain
marking: leaving contrails or otherwise making aerial detection easy for opposing aircraft; (F-4 Phantom was nicknamed the "Smokin' Thunderhog")
MiG: Mikoyan-Gurevich design bureau (USSR)
MSA: Minimum Safe Altitude
MSL: Mean Sea Level
mud: refers to anything having to do with the ground, i.e Air-to-Mud Ordnance
"Mud Launch": urgent call that enemy SAM has been launched at you
"Music": enemy aircraft is jamming your radar

N

"Naked": no RWR or information on enemy
nautical mile (nm): equal to 1.15 statute miles or 6,076 feet, approximately equal to one minute of latitude
negative: unable to comply
No Joy: opposite of Tally, no visual contact with opposing aircrew
"Nordo": term meaning the aircraft has lost radio communications, signaled by rocking wings
"Nose high- Goes high": pilot dictum when approaching another aircraft head-on, used to avoid collisions

O

Ooops: what you say to your wingman after letting a MiG-29 get into his "six"
OPFOR: opposing forces, usually used in training to describe "aggressor squadrons"
overshoot: potentially dangerous position of being forced out in front of an opposing aircraft

P

package: group of different aircraft combined to perform a single mission
padlocked: crew cannot take eyes off of target without losing it
passive: a non-emitting, undetectable system
payload: the useful load of an aircraft incl. ordnance, fuel, etc.
pickle button: control for releasing ordnance
picture: asking AWACS for an overview of the battle
pilotage: navigating using visual landmarks on the ground
pipper: small dot in the center of the target reticle, represents the line of sight
pit: slang for the rear cockpit, the WSO's seat in the aircraft.
pitch: movement of the aircraft around its lateral axis
Pk: probability of kill
PRF: Pulse - Repetition Frequencies
"Press": keep doing what you're doing, keep up the pressure on enemy
Pucker Factor: method of rating particularly hazardous missions
PW: Pratt and Whitney, engine manufacturers

R

radar: (Radio Detection and Ranging) a pulsed beam of energy used to scan for, detect, and return information about a target
Red Baron: Manfred von Richtofen; WWI German ace and patron saint of fighter-jocks everywhere
RED FLAG: Air Force training exercises held over the Nevada desert and staged from Nellis AFB
relative wind: direction of oncoming wind, usually refers to wind forced past an aircraft by its forward motion
"Rejoin": return to close formation flying (3 ft. wing clearence)
ROE: Rules of Engagement
"Roger": an affirmative response
ROK: Republic of Korea (South)
rotation speed: speed at which the nose of the aircraft is lifted for take-off
RTB: Return to Base
RWR: Radar Warning Receiver

S

"saddle up": attacking aircraft has established a position behind a target and all relative motion between the two has ceased
SAM: Surface to Air missile
SAR: Search and Rescue, alternate usage; synethic aperature radar
SARH: Semi-active Radar Homing
scramble: quick take-off
SCUD: East Bloc SSM made famous during the Gulf War
section: a pair of aircraft acting in unison
semi-active: homing guidance provided to a weapon by an outside source which is illuminating the target
"Shack": direct hit on target
shooter: aircraft that is designated to release ordnance
slick: the aircraft is flying with no external equipment to create drag, alternatively used to describe a low-drag bomb
"SNAP": command for immediate and direct heading to objective
Snap Shot: high angle gun shot
SNIFF: the stand-by mode for the radar which does not emit radiation
sortie: one flight mission by one aircraft
"Spike": a threat warning of enemy air radar with "lock-on"
"Spike Mud": a threat warning of enemy ground radar with "lock-on"
splash: air to air kill or weapons impact on ground target
squawk: sending a specific code, mode, or function giving information on your aircraft
stall: a function of the aircraft's angle of attack, the maximum lift capability for that airfoil is exceeded resulting in an abrupt loss of lift
"Straight lines-little hooks": how to maneuver in combat at high speed
"Stripped": attack will cause pilot to leave formation
Su: Sukhoi design bureau (USSR)

T

tactical: engaged in battle; usage: "I'm completely tactical."
Tally-Ho: sighting of a confirmed target, opposite of No Joy
Target Rich Environment: area of operations has many eligible targets
TFR: Terrain Following Radar, TF mode
TLAR: (That Looks About Right) method of bombing using unguided munitions
"Tracking": achieved a firing solution and attacking target with guns
trailer: last aircraft in a formation
Tumbleweed: a request for information, no Tally, no contact
Two-shipper: standard flight of two aircraft, lead and wingman

V

***V*:** velocity (speed)
***V*max:** maximum possible velocity
Vortices: spinning air currents produced by wing surface edges

W

"winchester": no ordnance remaining, essentially unarmed

Z

zoom climb: converting excess forward energy into an extended climb

II. DESIGNER'S NOTES: PUTTING WINGS ON THE EAGLE

THE SCENARIO

Over the years, F-15 Strike Eagle has been a hallmark product for MicroProse Software. It put us on the map back in 1983 when Sid Meier conceived, designed, and programmed the original version, which became an immediate hit. Recognized as being highly innovative, it introduced the fundamental concepts of a mission-based combat flight simulator. Included in the original game were real-world navigation, realistic flight models, appropriate enemy tactics, ground and air threats, and realistic weapons/ countermeasures usage. Even with the plethora of these types of products available in the marketplace today, they are all based on the same underlying ideas as that first game.

Through the years, those original concepts were refined and built-upon with efforts like Gunship, Gunship 2000, F-19 Stealth Fighter, Knights of the Sky, and F-117A Nighthawk. Added features included mission briefing and debriefing screens, pilot rosters, promotions, awards, campaigns, and reality options for customizing the game experience. Each of these products also provided a somewhat different type of game in that the vehicles simulated had very different missions.

The processing power of personal computers has increased over time as well, allowing for greater realism in both the visual and audio presentation. Graphics have gone from being merely representative to picturesque, and yesterday's squeaks and clicks have turned into today's stereophonic multi-channel synthesized and digitized sound. Even the user's interface devices have progressed from the simple keyboard and joystick of old, to highly authentic multi-function joysticks with throttle controls and, of course, the mouse.

Even within this type of rapidly changing environment, a good game is still a good game; it may just feel a bit dated. F-15 Strike Eagle had always been a good game but, periodically it started to show its age. For this reason we have continued to update it, first in 1989 with F-15 II, where the lessons learned in Gunship and F-19 were applied, and now with F-15 Strike Eagle III.

MISSION BRIEFING

The combat flight sim market has matured of late, leaving room for many types of products. They run the entire gamut from highly action oriented to super-realistic and complex, leaving game designers the unenviable task of deciding just which elements make a game more "fun". All the while, aficionados of these products support their preferences with a religious fervor.

Our mission with F-15 Strike Eagle III was to span as much of that gamut as possible in a single product, striving to provide a superior gaming experience for all types of players. We set out to separate the reality progression from the challenge progression so that players could have fun their own way. This would provide an easy learning curve so novices would not be scared away. At the same time, hard-core reality buffs would have their hands full operating the simulation just as a real pilot would.

Because its predecessor, F-15 II, filled the bill nicely as to accessibility and learning curve, we chose not to try to change those elements of the game. We did look for ways of expanding on the play options available, especially in the area of two-player interaction.

The graphics and sound presentation would also have to be revised to properly draw the player into the game. Most of the work, though, would come in the areas of increased complexity and realism to give the game wider appeal and longer play value, especially for the serious player.

THE MISSION - "TAKE 1"

The credits list of this product reads like a virtual who's-who of the senior staff at MicroProse, but it certainly did not start out that way. Though it eventually turned into an all-out, full scale offensive, it was originally

conceived as a small-team covert operation. As a veteran of many of MicroProse's combat flight sims (Gunship, F-19 Stealth Fighter, F-15 Strike Eagle II), I was convinced to undertake and lead the project as producer, game designer and programmer.

The first order of business was to investigate new gameplay alternatives. Two-player interaction via modem or direct-connect provides an excellent means of entertainment since a human opponent will almost always provide more of a challenge than a computer. Head-to-Head competition, two-plane wingman cooperative missions, and a unique two-player, one-plane, Pilot/WSO mode were implemented using F-15 II as a basis.

The in-game graphics were the next task, and hi-resolution Super VGA was on everyone's lips as the wave of the future. Several months were spent upgrading the 3D visuals, with good-looking results. Unfortunately the frame rate was not what we had hoped for.

Meanwhile, progress was being made on the wrapper screens, with veteran artist Barb Bents directing these efforts. She was instrumental in defining a consistent photo-realistic style throughout the product, rendering most of the wrapper screens and animations herself, and overseeing the efforts of others. Her work was consistently of the highest quality and, best of all, she did it quickly.

Another early member of the team was Frank Vivirito, whose experience with hi-end CAD tools was put to good use preparing a product concept demo used for trade shows. His work brought much attention to the product during the early stages of development. Working closely with Barb, he built a virtual model of an airbase as a stage in which to set all of the wrapper screens. Later, Frank made sure F-15 buyers would have a good first impression of the product by putting together the slick opening animation.

THE MISSION - "TAKE 2"

Those early efforts were significant, but after taking a hard look at the emerging product, we decided a new approach was in order. For one, we were wrong about SVGA, it just was not there yet. Secondly it became clear that the ante had been raised significantly by the competition both in terms of depth of gameplay, and in the form of superior graphics presentation. It was time for a change.

In redefining our efforts, a whole new style of development was implemented with the forming of the Simulations Group. Within this new framework, roles would overlap allowing people to lend their own special talents to more than one project at a time. This concept allowed us to dramatically increase the resources for F-15 III, while at the same time, producing the Gunship 2000 Islands & Ice Scenario disk.

Key amongst the new additions was senior programmer Scott Spanburg, a veteran of Airborne Ranger, M1 Tank Platoon, and Knights of the Sky. His work on the authentic flight model brought much-needed realism to the product. His revolutionary new visual system gave us the look of textured polygons without the computational cost. For the player this translates into greater feeling of motion across the ground and sky. For once you can tell clearly when you are about to crash into the ground or water. Similarly, the cloud-filled sky helps the player maintain spatial awareness as he performs loops, rolls, and turns. Also, much more ground detail is now possible at less cost than traditional polygonal methods. This is evidenced in the airbases, major cities, the water and the coastlines. He built the runtime system and all of the world building tools, enduring constant suggestions for upgrades and enhancements.

Working closely with Scott was Max Remington, ace 3D object and world-builder for all of MicroProse's 3D sims. Responding to customer demands, Max built the most complex and richly detailed polygonal 3D plane ever seen in a PC flight sim. View the animating landing gear as each door opens separately and the gear rotates up/down. Check out all of the ordnance on the plane and how it animates through the launch sequence. Note also the truly translucent cockpit, the animating speed brake, and correct marker lights. Our only regret is that for disk and memory constraints, we could not put this much detail into all of the enemy planes.

Max also worked closely with Scott to actually build all of the worlds. With the help of Susan Ullrich, they constructed each of the several hundred different 3D objects that can appear, and properly placed them in thousands of instances in each theater. Military maps provided an overall basis, while tourist maps of the larger cities were used to accurately place roads and landmarks exactly where they belong. Max never ceased to live up to his nick-name of "Maximum", pushing the limits of every constraint we gave him.

Brought on to share in the overall design effort was another heavy-hitter, Jim Day of Gunship 2000 fame. Though his influence was felt throughout, his specific major contributions include designing the A/A radar and HUD system, the authentic TEWS, the mission scoring, the damage system, and the speech cues. With a penchant for realism, Jim's ideas and opinions were given the highest regard throughout, adding dramatically to the depth of the game. In fact, Jim's talents were required to describe the more technical aspects of all that realism in the manual.

Perhaps the most influential member of the team was a newcomer to MicroProse, but certainly not to flight. Lt. Colonel George P. Wargo, USAF (ret.) just walked in through the front door one day and started a whole new era in authenticity in MicroProse jet sims. You see, George spent 20 years flying fighters for the Air Force, the last five of which were in F15's. There is just no substitute for having someone like that on your team. His knowledge of real flight, combat tactics, situational awareness, and Air Force procedure has been an invaluable asset and his involvement at MicroProse is a boon to flight sim buffs everywhere.

George's insight touched all aspects of the product. He consulted with Scott on the real flight model, with Frank on the formation flying animations, and with Jim, Bill, and me on the weaponry and radar systems. He worked closely with Scott and Max in laying out the worlds. His accurate historical knowledge of the Kuwaiti Theater of Operations allowed us to put threats and potential targets in their actual locations. In addition to the knowledge in his head, George gave us access to all of his personal non-classified tech manuals, including Air Force books on fighter technique, military maps, and of course, the actual F-15 "owners manuals". Suffice it to say that we know how the actual plane works, and now you do too.

Implementing all of this new super-realistic weaponry was quite a task. Programmer Bill Becker (Knights of the Sky) worked with a vengeance to accurately implement all of the air-to-air weaponry, including the radar system, the HUD displays, the authentic TEWS and the missile tracking logic. He never flinched when asked to add another missile type, radar mode, or HUD icon. He also built the in-game menu bar system.

Detmar Peterke who did all of the wrapper screen programming for Gunship 2000, was called upon to lend these same talents to F-15 Strike Eagle III. Using the style of hot-spot interface that he pioneered in his previous work, Detmar feverishly took to the task of making it easy for players to select all those options, see all the mission results, and getting all of those animations to fit in memory. His eye for detail and knack for an intuitive interface show well in the final result.

Additional programming was done by Don Goddard and Ned Way. Don contributed the ADI, HSI, and ILS systems, and also put together the install program. Ned endured a never-ending evolution of mission generation ideas to give you a constant variety of missions that make sense. He is also responsible for the boot disk maker.

Budding game designer, Chris Clark, assisted throughout procuring maps, building data files for targets and missions, and, together with George, helped tune the multi-player modes of the game. His level of enthusiasm was unparalleled and served to motivate us all.

New staff member Lawrence Russell was added late in the project to undertake the foreboding task of effectively communicating to the users of this product the proper method of play. In other words, Larry wrote the manual. Having only the Gunship 2000 Islands and Ice Scenario Disk manual as his industry experience, Larry pursued the undertaking with verve and vigor. Under tremendous deadline pressure he and Jim Day worked together to complete the book in record time. Its a tough task to describe a product as complex as this one in simple terms, but they were up to the task.

One of the most critical pieces of static artwork in a flight sim is the cockpit, since the player sees it so much. We needed a set of cockpits that were highly realistic looking, proportionally accurate, and fully functional. To perform this miracle we brought in Murray Taylor, who exceeded all of our expectations. Compare with the pictures in this manual. Check out the glint effects as the plane rolls. I think you will agree it is our best effort to date.

The huge amount of wrapper artwork required for F-15 III was too much for one person to handle. Art director, Barb Bents, was ably assisted by Ed Bendetti, Andy Lakin, Erroll Roberts, Artino, and Stacey Clark.

Though it is usually one of the last things added to our products, sound is certainly a major contributing factor in providing a convincing environment for the player. In this case Ken Lagace led a team including Scott Patterson, Jim McConkey, Roland Rizzo, and Jeff Briggs. Without downplaying their usually excellent job of implementing the array of sound

effects, standout efforts were made by Scott, who went out of his way to satisfy our specific requirements for digitized speech, and Jeff, who composed music that met with our intensely critical approval.

An even larger group, whose efforts also come at the end of the development cycle, is the Quality Assurance staff. Led by Vaughn Thomas, the crew worked long hours to play the game in all of its many complex variations, and find all of those strange situations the designers had not considered. They were relentless in their search for even the most minute inconsistency.

My role in all of this varied quite a bit as the development effort evolved. Originally cast in the leading role of a one-man-show programming and design-wise, I eventually ended up spending much of my time guiding the talented group of people named above. Keeping the whole lot focused on a common vision was difficult at best; keeping them all talking to each other at any one time was impossible.

DEBRIEFING

Our design goals have been exceeded well beyond our original expectations. The most obvious results of our work come in the look and feel of the product. The photo-realistic style makes you feel like you are really there, enhancing the "suspension of disbelief" and drawing you into the fighter pilot experience as never before.

Living inside this new presentation is a highly configurable game design. At "standard" levels, we have maintained the quick action and intuitive play of the original, making for an excellent entry-level for the casual gamer.

As one spends more time with the product and begins switching on the authentic modes, the game takes on a new life, becoming a true simulation. The strategic element of radar avoidance becomes paramount and air-to-air encounters are more of a cat-and-mouse game. These combine to enhance the tension buildup of a successful air-to-ground delivery. Add to this the tremendous variety of missions, theaters, and gameplay options, and you get a product that provides a rich and complex gaming experience suitable for even the most hard-core combat flight sim buff.

The creative synergy at work during the development of F-15 Strike Eagle III was nothing short of amazing, with the bulk of the work being completed in just ten short months. The common goal of product excellence reined supreme throughout, with all decisions being made for the sake of the product, not the ego. All of the long hours and hard work have now paid off and we have a product that we are each quite proud of. We hope that it will provide you with many hours of enjoyment.

— Andy Hollis
Producer, Simulations Group
November, 1992

335TH FIGHTER SQUADRON — THE CHIEFS

Projects of this magnitude are seldom accomplished without some outside assistance; and ***F-15 Strike Eagle III*** is no exception to this axiom. We were extremely fortunate to have the assistance of, none other than, the U. S. Air Forces' preeminent F-15E unit — the 335th Fighter Squadron "The Chiefs."

The 335th is an integral part of the 4th Fighter Wing, based out of Seymour Johnson AFB in North Carolina. Members of this Desert Storm tested unit provided a wealth of information and insight into the operation of the F-15E. We came away from this experience with an enriched appreciation for this superlative fighting machine and the pilots and wizzos that fly it.

Over the course of two full days, we got to observe virtually every aspect of what it takes to get one of these birds up and on its way. Understandably, the only thing unavailable was the classified data.

Whether up in the control tower watching massive KC-10 tankers making nighttime touch-and-goes, maintenance crews feverishly working to turn aircraft around, or sitting with the crew chiefs in a "bread truck" out on the flight line, every individual went out of their way to make us feel welcome. Never once did we feel we were intruding into their world. This is not a standard component found in the job description of any member of the Armed Forces. I wish I could single each and everyone out. I would have to post the entire base complement to accomplish it.

In any event, I am want to recognize a few special individuals for their contribution and assistance:

Many thanks to Brigadier General Hal Hornburg, 4th Fighter Wing Commander, for authorizing our visit to Seymour Johnson AFB.

Thanks to Lieutenant Colonel Kenneth Decuir, 335th Squadron Commander, for opening the doors to The Chiefs.

Major Larry Coleman, Assistant Operations Officer, for organizing our visit and working the miracles necessary to make things happen at a moment's notice. This was a true demonstration of military flexibility.

Captain William Millonig for sitting through our endless questions about what makes the F-15E what it is. His patience was nothing short of commendable and his explanations made what at first seemed complicated, clear and understandable.

The air-to-air briefing crews, aircraft commanders Captains Richard Bennett and Chris Kupko, and WSOs Captains Michael Hodges and William Sullivan — recognizing their forbearance for allowing us to sit in on an actual air-to-air mission briefing.

The air-to-ground briefing crew, aircraft commander Captain William Millonig and WSO Major Joseph Manion — they developed and staged an actual Desert Storm Scud Busting mission briefing.

Lieutenant Joseph Baniak for all the hanger and flight line information, and for watching over us as we traveled around the base.

Last, but certainly not least, Captain Alan Botine for his masterful introduction to an actual F-15E Strike Eagle and its related weapon systems — there is nothing like the feel of an actual cockpit.

It is almost impossible to describe how much any of this is reflected in ***F-15 Strike Eagle III*** as you see it today. Let it be said that it is all there in spirit as well as substance.

— Jim Day
October, 1992

Hans Halberstadt/Arms Communication

The design staff would also like to express its personal thanks to Lt. Colonel George "Wildman" Wargo, USAF (ret.) whose help through this entire project was invaluable. Whenever we had a technical question regarding some minute detail, George had the answer. Nothing got by him without being correct. His standard line to the rest of us was always, "Been there, done it, got the T-shirt."

— The F-15 Strike Eagle III Design Team

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